

# MONTHLY WEATHER REVIEW.

(GENERAL WEATHER SERVICE OF THE UNITED STATES.)

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WAR DEPARTMENT,  
OFFICE OF THE CHIEF SIGNAL OFFICER,  
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

## INTRODUCTION.

This REVIEW presents a general summary of the meteorological data collected by the Signal Service during the month of July, 1882.

The more prominent meteorological features of the month have been:

1st: The unusually high pressure, which has been above the normal in all sections of the country, except on the eastern slope of the Rocky mountains. The pressure ranged from normal in the New England states, to 0.08 inch above the normal in the Gulf states, and on the Pacific coast the same conditions prevailed, the pressure being from 0.02 to 0.08 inch above the normal.

2d: The deficiency in temperature, which has been below the normal throughout the country, except in New England and in the middle and south Pacific coast regions, where it was slightly above. In all other districts, the temperature ranged from 0.3 below the normal in Tennessee, to 6°.0 below the normal in the upper Mississippi valley.

The month has been particularly marked by the absence of storms, only six well-defined storm-centres occurring within the limits of the Signal Service stations during the month, and these did not exhibit any special energy. Local storms and tornadoes were comparatively few in number and were not very severe.

The rainfall has been below the average, except in that part of the country lying south of the thirty-sixth parallel of latitude.

Severe drought has prevailed in the New England states, and has to some extent injured the crops in that part of the country. In all other sections, the crops are almost uniformly reported to be making favorable progress. A large portion of the wheat crop has been harvested; the yield having proved above the average. The condition of the corn crop is reported to be promising, but owing to the cold weather during the planting season, it is from two to three weeks late.

The cotton region reports are continued, and for purposes of comparison, the tables of temperature and rainfall are given for the three months preceding July. The condition of the cotton crop is in general satisfactory.

Insects have been numerous in New England and caused severe ravages in crops, especially in Connecticut and Massachusetts.

The chart showing the limits of icebergs in the North Atlan-

tic ocean is continued, but the reports of vessels encountering ice are less numerous than for the two preceding months.

That part of the REVIEW referring to International Meteorology presents the general weather conditions which prevailed over the northern hemisphere during the month of May, 1880, the most marked feature being the prevalence of high pressures over central Europe during that month. Chart v. exhibits the tracks of barometric minima for August, 1880, traced from simultaneous observations taken at 7:35 a. m., Washington mean time, and will be found interesting as showing the tracks of three West Indian hurricanes, and of four typhoons occurring in the China sea.

In the preparation of this REVIEW the following data received up to August 20th, have been used, viz.: the regular tri-daily weather charts, containing the data of simultaneous observations taken at one hundred and thirty-six Signal Service stations and twelve Canadian stations, as telegraphed to this office; one hundred and eight-two monthly journals and one hundred and seventy-three monthly means from the former, and twelve monthly means from the latter; one hundred and eighty-seven monthly registers from voluntary observers; fifty-four monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; Marine Reports through the co-operation of the New York Herald Weather Service; abstracts of Ships' Logs, furnished by the publishers of "The New York Maritime Register"; monthly reports from the local weather services of Kansas, Nebraska, and Missouri, and of the Central Pacific railway company; trustworthy newspaper extracts; special reports.

## BAROMETRIC PRESSURE.

The mean barometric pressure for the month of July over the United States and Canada is shown by the isobarometric lines, in black, on chart ii. The area of lowest mean pressure covers Arizona, portions of Colorado, New Mexico and Utah, where the mean pressure ranges from 29.79 to 29.87 inches. The pressure gradually increases to the north, east, and west of this region, and is greatest over the south Atlantic states, Florida, the east Gulf states, and the north Pacific coast region. Compared with the previous month, the pressure is everywhere higher. In the northern slope the increase ranges from 0.06 to 0.12 inch; in the upper Mississippi and Missouri valleys, from 0.03 to 0.14 inch; in the lake region and Ohio valley, from 0.04 to 0.13 inch; in New England and the middle Atlantic states, from 0.09 to 0.13 inch; in the Gulf states, from 0.04 to 0.09 inch, and on the Pacific coast, from 0.03 to 0.08 inch.

## DEPARTURES FROM THE NORMAL VALUES FOR THE MONTH.

Compared with the means of previous years, the pressure is generally above the normal over the country east of the one hundredth meridian, the increase being from normal to 0.08 inch. On the Pacific coast, the pressure is from 0.02 to 0.08 inch above the normal, and at stations in Wyoming, Colorado, New Mexico, and Nevada, from normal to 0.08 inch below.

## BAROMETRIC RANGES.

The range of pressure during the present month has varied from nineteen to eighty-five hundredths of an inch, the greatest range being reported from Saint Vincent, Minnesota, and the least from Fort Grant, Arizona. In the several districts the barometric ranges have been as follows:

*New England:* From 0.72 inch at Springfield to 0.84 inch at Mount Washington.

*Middle Atlantic states:* From 0.58 inch at Lynchburg to 0.78 inch at New York and Sandy Hook.

*South Atlantic states:* From 0.41 inch at Jacksonville to 0.57 inch at Charlotte.

*Florida peninsula:* From 0.24 inch at Key West to 0.36 inch at Cedar Keys.

*East Gulf states:* From 0.28 inch at Vicksburg to 0.39 inch at Montgomery and Starkville.

*West Gulf states:* From 0.27 inch at Galveston to 0.39 inch at Fort Smith and Little Rock.

*Rio Grande valley:* From 0.25 inch at Brownsville to 0.35 inch at Eagle Pass.

*Ohio valley and Tennessee:* From 0.37 inch at Memphis to 0.58 inch at Pittsburg.

*Lower lake region:* From 0.52 inch at Toledo to 0.68 inch at Oswego.

*Upper lake region:* From 0.50 inch at Chicago to 0.75 inch at Marquette.

*Extreme northwest:* From 0.59 inch at Fort Stevenson to 0.85 inch at Saint Vincent.

*Upper Mississippi valley:* From 0.45 inch at Saint Louis to 0.68 inch at Saint Paul.

*Missouri valley:* From 0.44 inch at Springfield to 0.67 inch at Yankton.

*Northern slope:* From 0.46 inch at Cheyenne to 0.70 inch at Fort Custer.

*Middle slope:* From 0.31 inch on summit of Pike's Peak to 0.50 inch at Denver and Dodge City.

*Southern slope:* From 0.30 inch at Fort McKavett to 0.44 inch at Henrietta.

*Southern plateau:* From 0.19 inch at Fort Grant to 0.40 inch at Prescott and 0.41 inch at La Mesilla.

*Middle plateau:* From 0.37 inch at Pioche and Winnemucca to 0.44 inch at Salt Lake City.

*Northern plateau:* From 0.39 inch at Eagle Rock to 0.54 inch at Lewiston.

*North Pacific coast region:* From 0.43 inch at Roseburg to 0.48 inch at Olympia.

*Middle Pacific coast region:* From 0.33 inch at San Francisco to 0.37 inch at Red Bluff.

*South Pacific coast region:* From 0.25 inch at San Diego to 0.34 inch at Yuma.

## AREAS OF HIGH BAROMETER.

Five well-defined areas of high barometer have appeared within the limits of the map. They have pursued their usual track to the south of east. All have first appeared on the northern boundary of the United States between Minnesota and Idaho. None of the high areas have been associated with any strongly defined weather conditions.

I.—On the 1st, there was a sharp rise in pressure in the northwest and upper lake region in rear of low area i., then moving over the lower lakes and down the Saint Lawrence valley. On the 2d, there was a barometric rise of nearly 0.3 inch in the lower lakes and middle states, and at the end of

the day there was a great depression in the maritime provinces of Canada, averaging nearly 0.4 inch below the mean, and a second depression, low area ii., was advancing eastward from the northwest, and on the 3d the high pressure, moving in a southeasterly track, disappeared beyond the limits of the chart.

II.—On the 3d, the barometer rose from 0.3 to 0.4 inch in Montana, Dakota, and the northwest, in rear of low area ii., then moving in a southeasterly track down the Mississippi into the Ohio valley. The pressure in the two territories named averaged from 0.2 to 0.3 inch above the mean; on the same day the temperature in the northwest and lake region was from 10° to 15° below the mean for the month. On the 4th, the centre of high area moved in a southeasterly direction into the upper Mississippi valley and upper lake region, accompanied by clearing weather and northerly winds, which veered to the south and east in the Missouri valley and Manitoba. On the same day the temperature was from 15° to 20° below the mean in the lake region, Ohio valley and middle states. On the 5th, the high barometer extended from the lake region to the Gulf of Mexico, accompanied by unusually fair or clear weather, and the temperature continued from 5° to 20° below the mean for the month, east of the Mississippi river. On the 6th, the high pressure was transferred to the south Atlantic and middle Atlantic states, and clear weather with light northerly winds prevailed. On the 7th and 8th, the pressure remained highest, but only slightly above the mean, in the middle Atlantic and south Atlantic states during the disappearance of low area iii. in the upper lake region, and the approach of low area iv. into Dakota. On the 9th, 10th, and 11th, the highest barometers reported were from the south Atlantic and east Gulf states, while a great depression—not charted—existed in the lake region and Saint Lawrence valley. With respect to extent and duration, this was the most important high area of the month. The minimum temperatures for the month occurred during its prevalence, including many stations in the Mississippi valley, and in general in the lake region, Ohio valley, Tennessee, east Gulf, south Atlantic and middle states.

III.—There was a sharp barometric rise on the 11th in Idaho, Montana and Manitoba. At the morning observation of the 12th, the reported pressures from Idaho and Montana were from 0.36 to 0.49 inch above the normal; during the day the high area moved into the Missouri valley, accompanied by low temperatures, northwesterly winds and clearing weather. On the 13th the high area extended from Manitoba to the Gulf; on the 14th from the lake region to the Gulf and Atlantic coast states; during the day generally fair weather was reported from the interior of the country east of the Mississippi river, and general rains along the Atlantic coast. On the 15th, the pressure rose in the lower lakes, New England and middle states during the progress of low area vi. over the northwest. In these districts the barometer averaged nearly 0.3 inch above the normal. On the 16th the barometer rose along the middle Atlantic and New England coast; the highest pressures reported were Sandy Hook, 30.32, Philadelphia, New York and Block Island 30.33, and Boston and Baltimore 30.31, or from 0.35 to 0.4 inch above the mean. On the 17th the high area moved slowly to the eastward beyond the limits of the chart. In connection with this high area the minimum temperatures were quite generally reported from Idaho, Utah, Montana, Wyoming, Dakota, Colorado, Nebraska and Kansas.

IV.—On the 18th the pressure was high in the upper Missouri valley, averaging 0.2 inch above the normal. On the 19th the high area extended over the northwest, with clearing weather and northwest winds, and temperatures 10° to 15° below the mean for the month. On the 20th the barometer generally rose east of the Rocky mountains, remaining highest in Manitoba, Minnesota and Iowa. On the 21st, with a general rise east of the Mississippi river, the barometer still continued highest in the same region as on the previous day, when the pressure was from 0.25 to 0.3 inch above the normal.



On the 22d, the high area extended from lakes to the Gulf and Atlantic coasts, a sharp barometric fall taking place the same day in the extreme northwest. On the 21st and 22d, general, heavy rains, accompanied by northeasterly winds, were reported from the southern and eastern boundaries of the high pressure. On the 23d, the high area remained nearly stationary in position. On the 24th, with a general fall in pressure, the highest barometer was transferred to the middle Atlantic coast. The centre of high area on the 25th, 26th and 27th, extended, without exercising any special weather changes, to the south Atlantic and east Gulf states. During the prevalence of this high area the temperature in the regions covered by it were in general below the mean for the month.

V.—On the 27th there was a marked rise of pressure in Manitoba. On the 28th the high area extended over the upper lake region. On the 29th, it was central over the entire lakes, where clearing weather was reported with northerly winds. On the 30th, there was a rapid transfer of the high area to the middle states, New England and the maritime provinces of Canada. On the 31st the barometer continued rising in the middle states and New England, with south to east winds. At the 11 p. m. observation the highest readings of the month were recorded: Provincetown, 30.38; Boston and Block Island, 30.36; New Haven, 30.35; New York and Sandy Hook, 30.34; Philadelphia, 30.33, and Portland, 30.32. These readings were from 0.35 to 0.42 inch above the mean for the month.

#### AREAS OF LOW BAROMETER.

Six areas of low barometer have been sufficiently defined to permit their tracks to be charted, within the limits of the stations of observation. These tracks are exhibited on chart number i. Compared with the month of July in previous years, the storm-centres have shown a great diminution of energy; only seven cautionary signals being displayed for the month and these along the New England coast. It is worthy of note that the maximum temperatures for July do not as a rule correspond in date with the progress of any of the low areas charted. These temperatures generally occurred when the pressure over the country was near the mean, and during the prevalence of the usual southerly winds, resulting from such a distribution of pressure.

The following table gives the latitude and longitude in which each area was first and last observed, and the average hourly velocity:

Areas of low barometer.	FIRST OBSERVED.		LAST OBSERVED.		Average velocity in miles per hour.
	Lat. N.	Long. W.	Lat. N.	Long. W.	
No. I.	40° 00'	115° 00'	46° 30'	61° 00'	19.4
II.	47° 00'	107° 00'	48° 30'	96° 30'	22.6
III.	46° 00'	105° 00'	43° 30'	89° 00'	12.7
IV.	48° 00'	111° 30'	49° 00'	95° 30'	15.0
V.	46° 00'	85° 30'	49° 00'	63° 00'	32.2
VI.	46° 30'	109° 00'	49° 00'	86° 00'	17.0

The following table gives the number of areas of low pressures during the month of July, since 1873.

Month.	Year.	No.	Month.	Year.	No.
July.	1873,	13.	July.	1878,	11.
"	1874,	11.	"	1879,	9.
"	1875,	8.	"	1880,	12.
"	1876,	8.	"	1881,	5.
"	1877,	8.	"	1882,	6.

I.—This is the low area described as low area ix. of the June REVIEW. At the morning observation of the 1st, the isobar of lowest pressure, 29.6, included the lake Ontario region, the barometer being nearly 0.4 inch below the normal; during the day the low area moved slowly to the eastward, accompanied by heavy and general rains in the middle states and New England. On the 2d, the depression, increas-

ing considerably in energy, moved over the maritime provinces and beyond the limits of the chart. The lowest pressures reported were: Yarmouth, 29.47; Halifax, 29.44; Sydney, 29.47; or averaging about 0.45 inch below the normal. The maximum temperatures were reported on the 1st in connection with this depression from some of the stations in Tennessee, Ohio valley, and Illinois. The following reports furnished through the co-operation of "The New York Herald Weather Service," probably indicate the presence of this storm during its movement eastward over the ocean: 2d, s. s. "Republic," in N. 41° 23', W. 55° 40', barometer 29.94, sse., force 6, sky overcast with detached clouds and raining. The following day, 3d, in N. 41° 46', W. 47° 59', the barometer had risen to 30.16, sw. by s., force 5, fair weather. On the 4th, in N. 44° 48', W. 40° 58', the storm had in all probability passed beyond and to the east of the vessel, the barometer being then 30.30, w., force 3, and misty.

II.—On the 2d, a depression, developing in Montana, moved in a track slightly to the south of east over Dakota, accompanied by local rains in Minnesota, Wisconsin, and Dakota. On the 3d, the low area pursued a southeasterly course, exhibiting but slight energy, into the Ohio valley. Rain was reported during the day from all the states east of the Mississippi river. On the 4th, the storm centre moved to the southeast into North Carolina, and then changed to a northeasterly track, being charted at the 11 p. m. observation near Chincoteague, Virginia, at which time high northeast winds were reported along the middle Atlantic coast. On the 5th, the centre of the storm area moved as charted, and high north to east winds continued on the New Jersey coast and Long Island sound. On the 6th, the depression first moved to the northward into the Saint Lawrence valley and thence along the valley to the Gulf. Cautionary signals were displayed in advance of this storm from New Haven to Portland, and were generally justified. The following reports furnished through the co-operation of "The New York Herald Weather Service," probably indicate the presence of this storm during its movement eastward over the ocean: s. s. "Bothnia," 6th, in N. 40° 40', W. 68° 21', barometer 29.96, southerly, force 3, sea confused, misty at intervals. The following day, 7th, the storm seemed to have passed beyond and to the northeastward of the vessel; in N. 41° 06', W. 61° 27', the barometer having risen to 30.20, winds still southerly, force 4, but the sea-swell being from the north, with cloudy weather.

III.—On the 5th a depression of slight energy developed in Montana and Dakota. On the 6th it moved in an easterly track over Minnesota, accompanied by general rains in the northwest and lake region. The lowest pressures reported were: Saint Paul, 29.57; Duluth, 29.58, or 0.37 and 0.36 inch below the normal respectively. On the 7th the centre of the storm-area, diminishing in energy, moved to the southeast and ceased to exist as a depression near Lake Michigan.

IV.—On the 7th, a depression developing in Idaho, moved slightly to the south of east over Montana. On the 8th, with a slight easterly movement, the centre remained in Dakota, and rain was generally reported from Dakota and Minnesota. On the 9th the low area moved to the northeast beyond the limits of the chart. The lowest pressures reported were: Moorhead, 29.55; Saint Vincent, 29.37; Fort Garry, 29.5, or respectively 0.4, 0.57 and 0.5 inch below the normal. Although the centre of depression cannot be charted after the 9th, the pressure fell on the 10th and 11th in the lake region and Saint Lawrence valley, in some instances falling 0.4 inch below the normal. During the progress of this low area, rain was reported from all the states east of the Mississippi river. The pressure did not rise to the mean in the upper lake region until the 13th, and in the lower lake region, middle states and New England until the 14th.

V.—The track of this depression should be considered in connection with the description of low-area iv. While the barometer continued low in the lake region, a secondary depression was first located on the 12th near Mackinac, Mich-

igan, which, exhibiting but slight storm energy, moved on the 13th down the Saint Lawrence valley and beyond the limits of the chart.

VI.—At the midnight report of the 13th, a depression became apparent in Montana. On the 14th, showing but slight energy, it moved into southeastern Dakota, with local rains reported from the Missouri valley. On the 15th the low area changed its course to the northeast over Minnesota, and general rain was reported from the northwest. On the 16th the depression moved, while the barometer continued low in the lake region, over the Canadian provinces.

#### INTERNATIONAL METEOROLOGY.

International charts iv. and v. accompany the present number of this REVIEW. Chart iv. is published for May, 1880, and continues the series of that chart begun in January, 1877. Chart v. is prepared for August, 1880, and continues the series of that chart from November, 1877. In the description of these charts, much valuable information has been obtained from the "Monatliche Uebersicht der Witterung," published by Professor Dr. G. Neumayer, Director of the German Marine Observatory, and from the "Bulletin Mensuel," published by Mr. Marc Dechrevels, of Zi-Ka-Wei, China.

Chart iv. exhibits the mean pressure, mean temperature and prevailing direction of the wind over the northern hemisphere for the month of May, 1880, as determined from one observation taken each day at 7.35 a. m., or 0.43 p. m. Greenwich mean time. Three areas of mean low barometer are exhibited on the chart, the first of which appears over British India, and is a constant feature of that part of Asia during the summer months. The isobar of 29.60 (751.8) encloses the central and eastern provinces of British India, where the mean pressure for the month was below 29.55 (750.6).

The second area of mean low pressure is also situated over Asia, and covers the whole of India, except the central provinces above referred to.

The third area of mean low barometer, 29.80, (756.9) extends over Greenland to northern Norway and Sweden, and thence over eastern and southern Russia. The isobarometric line of 29.80 (756.9) also covers Siberia eastward to the ninetieth meridian; it also covers the Chinese Empire south of the fiftieth parallel. An area of mean low pressure, 29.80, (756.9) also appears in North America over Minnesota and Manitoba.

Two areas of barometric maxima appear upon the chart; the first, 30.20, (767.1), occupies the Atlantic between the thirty-third and forty-fourth parallels of north latitude, and between 38° and 26° west longitude; the other, 30.10 (764.5), covers Texas and the Atlantic coast of the United States as far north as the fortieth parallel; it also extends eastward over the Atlantic, and includes the British Isles within its limits. The isobar of 30.00 (762.0) covers central and southern Europe, while that of 29.90 (759.4) extends over European Russia.

In North America, the high area of the Pacific covers the middle Pacific coast region, where the mean pressure ranges from 30.12 to 30.21 (765.0 to 767.3).

Compared with the preceding month (April), the pressure has increased over Greenland and northern Europe, the isobars of 29.60 (751.8) and 29.70 (754.6) being now replaced by those of 29.80 (756.9) and 29.90 (759.4). The pressure has remained nearly stationary in central Russia, but has decreased in the eastern part and in Siberia.

In Asia, the pressure has decreased generally in all parts of the continent, the most marked decrease appearing in China and Japan, where the mean pressure is about 0.10 inch below that of April.

In the United States, the mean pressure shows but slight changes. The high area of the south Atlantic extended farther northward during the month under consideration, and in Manitoba, the mean barometer was about 0.10 inch lower than in April. On the Pacific coast, the pressure was slightly above that of the preceding month.

Compared with the corresponding month of previous years, the mean pressure, in the United States, was above the normal on the Atlantic and Pacific coasts, and was slightly below the normal in the interior and northern parts of the country, the greatest deficiency occurring in Minnesota and Dakota.

In Canada, the pressure was slightly above the average, the greatest excess appearing in the maritime provinces.

The following table exhibits the mean pressure and mean temperature for the month of May, 1880, in the several countries of Europe and Asia, compared with the means as determined from observations taken during May in the years 1877, 1878, and 1879:

Countries.	Mean Barometer.			Mean Temperature.		
	May, 1877, 1878 and 1879.	May, 1880.	Depart- ure.	May, 1877, 1878 and 1879.	May, 1880.	Depart- ure.
Algeria.....	30.04	29.96	-0.08	72.9	71.9	-1.0
Austria.....	29.96	29.88	+0.02	62.2	63.2	+1.0
British Isles.....	29.90	30.13	+0.23	54.3	55.1	+0.8
Denmark.....	29.87	29.97	+0.10	52.2	53.6	+1.4
France.....	29.90	29.97	+0.07	60.9	64.7	+3.8
Germany.....	29.91	30.00	+0.09	58.6	59.3	+0.7
India.....	29.64*	29.62	-0.02	91.6*	89.7	-1.9
Italy.....	29.93	29.84	-0.09	67.0	68.6	+1.6
Norway.....	29.81	29.91	+0.10	52.6	51.2	-1.4
Portugal.....	30.03	29.91	-0.12	68.4	65.5	-2.9
Russia.....	29.87	29.92	+0.05	61.3	62.3	+1.0
Spain.....	29.97	29.93	-0.04	68.7	66.5	-2.2
Sweden.....	29.86	29.91	+0.05	48.4	50.6	+2.2
Turkey.....	29.94	29.92	-0.02	68.5	65.0	-3.5

\* May mean for two years only.

The accompanying table shows the deviations in temperature and pressure at isolated stations during the month of May, 1880, as compared with the mean of three years:

Comparative Thermometric and Barometric Means, with corresponding Departures.

STATION.	Mean Barometer.			Mean Temperature.		
	May, 1877-78-79.	May, 1880.	Departure.	May, 1877-78-79.	May, 1880.	Departure.
Laghouat.....	30.00	29.96	-0.04	81.3	76.6	-4.7
San Jose de Costa Rica.....	30.03	29.99	-0.04	70.2	69.3	-0.9
Gibraltar.....	29.94	29.88	-0.06	70.2	66.5	-3.7
Malta.....	29.85	30.00	+0.15	68.6	70.7	+2.1
Sandwich Manse.....	30.01	30.02	+0.01	48.1	49.9	+1.8
Bridgetown.....	30.08	30.06	-0.02	82.9	81.5	-1.4
Cape Town.....	29.94	30.10	+0.16	64.2	72.3	+8.1
Fort Napier.....	29.94	30.10	+0.16	72.1	71.8	-0.3
Free Town.....	29.87	29.98	+0.11	86.2	85.1	-1.1
Hobart Town.....	29.87	29.86	-0.01	55.7	51.8	-3.9
Mauritius.....	30.06	30.09	+0.03	74.8	75.1	+0.3
Melbourne.....	30.03	30.01	-0.02	53.6	52.5	-1.1
Nassau.....	30.00	30.08	+0.08	70.0	78.1	+8.1
Godthaab.....	29.91	29.76	-0.15	35.2	33.4	-1.8
Stykkisholm.....	29.87	29.91	+0.04	41.0	45.1	+4.1
Thorshavn.....	29.86	29.80	-0.06	45.4	47.3	+1.9
Fort-de-France.....	29.86	30.19	+0.33	81.0	79.2	-1.8
Zi-Ka-Wei.....	29.88	29.91	+0.03	63.4	63.7	+0.3
Athens.....	29.95	29.88	-0.07	74.3	73.8	-0.5
Lahore.....	29.90*	29.90	-0.00	96.2*	103.8	+7.6
Cagliari.....	29.92	29.85	-0.07	69.6	68.7	-0.9
Tokel.....	29.92	29.96	+0.04	61.7	61.3	-0.4
Tromso.....	29.77	29.79	+0.02	44.7	40.0	-4.7
Angra.....	30.11	30.24	+0.13	63.2	63.1	-0.1
Funchal.....	30.12	30.08	-0.04	69.3	64.9	-4.4
Ponta Delgado.....	30.14	30.16	+0.02	66.1	63.5	-2.6
Lisbon.....	30.04	29.94	-0.10	66.3	63.3	-3.0
Archangel.....	29.87	29.86	-0.01	48.4	44.8	-3.6
Tiflis.....	29.87	29.85	-0.02	71.9	70.0	-1.9
Astrakhan.....	29.90	29.91	+0.01	73.4	70.2	-3.2
Ekaterinburg.....	29.80	29.76	-0.04	55.7	61.5	+5.8
Nukuss.....	29.84	29.79	-0.05	82.3	80.4	-1.9
Tashkend.....	29.88	29.81	-0.07	78.7	77.5	-1.2
Barnaul.....	29.91	29.87	-0.04	57.0	57.4	+0.4
Yeniseisk.....	29.87	29.97	+0.10	47.4	50.7	+3.3
Pekin.....	29.81	29.73	-0.08	69.1	70.0	+0.9
Nikoljevsk on the Amoor.....	29.91*	29.83	-0.08	34.6	37.2	+2.6
Madrid.....	29.93*	29.93	+0.00	69.7	66.2	-3.5
San Juan de Puerto Rico.....	29.90*	30.04	+0.14	81.0	78.8	-2.2
Beirut.....	29.93	29.90	-0.03	77.2	73.0	-4.2
Mexico.....	30.00	30.00	-0.00	57.5	57.2	-0.3
Havana.....	30.00*	30.03	+0.03	78.7*	77.5	-1.2
Nayasa.....	29.95	29.98	+0.03	80.4	78.3	-2.1
Paramaribo.....	30.01	30.13	+0.12	81.6	80.3	-1.3
York Factory.....	30.02*	30.00	-0.02	28.1*	26.9	-1.2

\* May mean for two years only.

In North America, the temperature was above the normal over the entire country east of the ninety-fifth meridian, except



in Florida and the Canadian maritime provinces. On the north Pacific coast the temperature was below the normal, and in the other districts of the Pacific coast, it was slightly above.

The following are some of the extreme monthly mean temperatures reported at isolated stations:

LOWEST.	Degrees.	HIGHEST.	Degrees.
York Factory .....	29.6	Manilla.....	85.6
Godthaab.....	33.4	Freetown.....	85.1
Nikolaievsk on the Amoor.....	37.2	Bridgetown.....	81.5
		Paramaribo.....	80.3
		Port de France.....	79.2

In British India the temperature was slightly below the mean; the highest monthly mean was reported from Lahore,  $103^{\circ}.8$  ( $+39^{\circ}.9$  Cent.), and the lowest,  $80^{\circ}.8$  ( $+27^{\circ}.1$  Cent.), at Goalpara.

The prevailing direction of the wind was, in the United States, southwesterly on the Atlantic coast, southerly in the interior, and southeasterly in Texas. In Dakota and Minnesota the winds were northwesterly, and on the Pacific coast they were generally southerly. In Canada they were southwesterly to westerly.

In Europe the prevailing directions were as follows: In central Europe, northerly and northeasterly; in Sweden and Norway, generally southerly.

In Hindostan the winds were generally westerly and northwesterly, except at Lucknow, Patna, and Hazaribagh, where they were easterly. In China they were southeasterly, and in Japan, southerly to southwesterly.

Over the north Atlantic, from  $N. 30^{\circ}$  to  $N. 50^{\circ}$  and west of the fortieth meridian, the winds were generally southwesterly; from  $N. 35^{\circ}$  to  $N. 60^{\circ}$  and east of  $40^{\circ}$  west longitude they were mostly northeasterly, except on the west coast of Ireland, where they were southwesterly.

The following brief notes, descriptive of the meteorological conditions over Europe during the month, are taken from the "Monatliche Übersicht der Witterung."

During the first half of the month, the barometric depressions were numerous, and prevailed mostly over the southern part of central Europe, while in the northern sections high barometer prevailed. During the second half of the month the above conditions were reversed, barometric minima prevailing in the north and high barometer in the south.

The most marked feature of the month was the prevalence of barometric maxima over central Europe. The first area of high barometer,  $30.55$  ( $776.0$ ), prevailed from the 3d to the 8th, and moved from Scotland over Germany toward southwestern Russia. The second area formed over the British Isles as the first reached Russia. From the 4th to the 10th this high area remained over the British Isles, and on the 14th it extended to northern Europe; about the 19th it reached north Germany, and on the 22d was over Spain, thence it moved slowly over the Mediterranean to Hungary, and disappeared in southwestern Russia on the 29th.

These areas of high barometer influenced the temperature in Europe to a marked degree, as is shown by the following: In Germany, from the 5th to 10th, the temperature fell below the normal; from the 10th to 15th it was above the normal; from the 15th to 19th there was a rapid fall, the minimum for the month being recorded on the latter date. From the 19th to 27th the temperature again rose rapidly, and reached the maximum on the last-mentioned date. During the night of the 18th-19th heavy and destructive frosts occurred, causing damage to crops and vegetables, and snow was reported from many points in the eastern and southeastern provinces. On the 27th the temperature rose above that usually recorded during the summer months of June, July and August, the maximum temperature reaching  $90^{\circ}.5$  ( $32^{\circ}.5$  Cent.) at Munster, province of Westphalia.

Chart v. exhibits the paths of barometric depressions which have been traced from the daily international charts for the month of August, 1880.

The data are charted for each day of the month, on the charts accompanying the "International Bulletin" for that day, and, from these charts and additional reports, the movement of the centres of barometric minima are traced.

Twenty-four of the principal storms occurring in the northern hemisphere have thus been traced.

Concerning the general distribution of these depressions, the following is given:

Eleven appeared in the United States and Canada, four of which have been traced to the Atlantic coast and across the ocean. The marked meteorological feature of the month was the appearance of three violent cyclonic storms,—an unusual number for August. They developed south of latitude  $20^{\circ}$  and followed a northwesterly course towards the coast of the United States, causing immense damage to shipping, buildings, crops and other property. Additional interest attaches to the storm described as number iv., which swept over the island of Jamaica on the 18th and 19th, as such visitations are comparatively rare at Jamaica; the West Indian cyclones generally passing so far south of that island, that they scarcely affect it.

Nine depressions appear over Europe, one of which—low-area xvii—caused much damage to shipping and other property during its passage over England and the North sea.

Three areas of barometric minima are traced in Asia, together with the tracks of four typhoons which swept the China seas during the month under consideration.

The following brief descriptions are given of the storms first appearing within the limits of the Signal Service stations:

I.—This low-area was central in Minnesota on the morning of the 1st, and, crossing lake Huron during the day, it passed down the Saint Lawrence valley on the 2d, the centre being near Farther Point, barometer,  $29.65$  ( $753.1$ ). During the 2d and 3d, the storm passed over Labrador to the ocean and was central on the morning of the 3d in about  $N. 57^{\circ}$ ,  $W. 51^{\circ}$ , the bark "Kryolith," in  $N. 57^{\circ} 05'$ ,  $W. 51^{\circ} 55'$ , reporting, barometer  $29.34$  ( $745.2$ ), drizzling rain, and on the same day, the s. s. "Gulnare" was driven within a few miles of Cape Farewell by a heavy southwesterly gale. On the 4th, the disturbance passed over southern Greenland and disappeared in the Arctic regions.

II.—This depression, evidently cyclonic, probably developed in the Caribbean sea on the 5th or 6th, on which days brisk to strong easterly winds and rain were reported from Saint Thomas, and on the 7th and 8th, Navassa reported brisk easterly wind and threatening weather; but these stations were too far north of the centre of disturbance to show any decided barometric fall. The barometer at Kingston, Jamaica, fell slowly during the 6th, and on the 7th heavy rain fell, with gusts of wind from the east and east-southeast. During the 8th, 9th and 10th the disturbance passed near the coast of Yucatan into the gulf of Mexico, doing much damage to shipping, as is indicated by the following reports: The s. s. "E. B. Ward" lost rudder and sustained other damage off Cape San Antonio on the 9th. On the 10th, the brig "Aldino" was wrecked on Alacran reef (about  $N. 23^{\circ}$ ,  $W. 91^{\circ}$ ), and in  $N. 20^{\circ} 06'$ ,  $W. 91^{\circ} 20'$ , the schooner "Seguin" encountered a revolving gale, in which she lost sails and sustained other damage. During the 10th and 11th the schooner "W. H. Keeney" had a hurricane from northeast to southeast. On the 11th and 12th, the cyclone pursued a northwesterly course toward the Texas coast; at 9.30 p. m. of the 12th the barometer at Brownsville read  $29.69$  ( $754.1$ ), or  $0.40$  inch below the normal, and at 11.45 p. m. of the same day the barometer had fallen to  $28.32$  ( $719.3$ ), being a fall of  $1.38$  inches ( $35$  millimeters) in two hours and twelve minutes, and the wind had increased to hurricane force. During the 13th and 14th, the centre of disturbance moved slowly up the valley of the Rio Grande, and on the 15th, the course having become more northerly, the depression filled up in western Texas. This storm was accompanied by very heavy rains,  $11.71$  inches, or  $297$  millimetres,

in twenty-four hours being reported at Brownsville. Many buildings were blown down and much damage resulted to shipping; at Matamoras, the destruction was still greater, more than three hundred houses having been blown down, and many others almost entirely submerged, owing to the overflowing of the lagoons. At Fort Brown the barracks were unroofed and several buildings demolished, and many horses and mules were killed. At Point Isabel, eight vessels were wrecked and several lives lost.

III.—This depression appeared in New Mexico on the 15th, and moved in a northeasterly course toward the Missouri valley, where it was central, with decreasing pressure, on the 16th. Moving thence north-northeastward, the centre entered British America on the 17th, and passed beyond the stations of observation.

IV.—Is the West Indian cyclone which swept over the island of Jamaica on the 18th. It was first observed by the s. s. "Nith," near Guadaloupe on the 15th, when that vessel encountered strong and increasing northeast winds with heavy squalls; the lowest barometric readings for the month were also reported from Fort de France, on the 14th and 15th, with light rains, and at Saint Thomas, on the 15th and 16th, the wind was easterly, with violent gusts and light rain, but with no decided change in pressure. On the 16th, the s. s. "Nith," in N. 16° 04', W. 65° 55', had variable winds with very high sea, followed later by heavy squalls and torrents of rain, which continued until the morning of the 17th; at noon of that date, the vessel was in N. 16° 10', W. 70° 26'; barometer reading 29.35 (745.5), wind veering from northeast to southeast and south, with heavy squalls and thunder and lightning. At San Domingo, vessels were driven ashore and wrecked by the heavy rolling seas, which preceded the hurricane, and continuous heavy rains prevailed from the 15th to the 19th. On the 18th, the s. s. "Nith" was in N. 16° 27', W. 74° 57'; barometer 29.15 (740.4), with terrific squalls from the east and southeast and torrents of rain, the storm increasing in violence towards noon; at 4 p. m., the wind veered to the southward and the storm moderated, and at midnight the weather was comparatively fine. At Navassa, on the evening of the 18th, the barometer read 29.78 (756.4), with fresh northeast winds increasing to severe gale, and heavy rain; at 4 a. m. of the 19th, the wind changed to southeast, forty miles per hour, and at 3 p. m. the barometer had fallen to 28.94 (735.1), with wind still southeasterly, but greatly moderated. On the 18th and 19th, the storm reached Kingston, Jamaica, where it caused great destruction to life and property. Mr. Maxwell Hall reports that the barometer fell to 28.93 (734.8) at 9.15 p. m. of the 18th, and the wind, which had been light and variable, shifted to south at 10 p. m., and increased to sixty miles per hour, the highest velocity being recorded at 10.15 p. m., south, eighty miles, and at midnight it was west-southwest and had moderated to twenty miles per hour. The weather during the two preceding days had been warm and sultry, with heavy rains, and the sea at the port was greatly disturbed, the waves rolling in from the east. The cyclone passed from the southeastern to the western part of the island, prostrating plantations, houses, telegraph lines, and wrecking many vessels, and causing loss of life; in some places, shocks of earthquake were also felt. On reaching the western end of the island, the disturbance followed a northeasterly course toward Cuba, over which island it passed without causing much damage. On the 20th, the brig "Stockton," in N. 20° 32', W. 73° 42', encountered a strong southerly gale, in which she lost and split sails. The subsequent movement of this storm can not be traced, owing to lack of data, although reports from Signal Service stations in Florida indicated the existence of a barometric disturbance at some distance to the eastward, and on the 21st, the barometer at Bermuda fell to 29.85 (758.2).

V.—This depression first appeared in Minnesota on the 17th, and, moving slowly eastward, the centre of disturbance was over Lake Superior on the 18th; it then followed a northeasterly course, and disappeared beyond the stations of observation on the 19th.

VI.—This area was first central in Nebraska on the 19th; it moved eastward toward the lake region, and on the 20th, the area of low barometer covered the lower lake region, with no well-defined centre. On the following day the disturbance moved down the Saint Lawrence valley, the centre being near Montreal. During the 22d, the depression moved across the Gulf of Saint Lawrence, and was central near Saint Pierre, Newfoundland, and on the 23d, it disappeared south of Greenland.

VII.—This depression developed in the Saskatchewan valley on the 20th, and, moving eastward, was central near Moose Factory on the 21st, the barometer at that station reading 29.50 (749.3), a fall of 0.30 inch in twenty-four hours. During the 23d and 24th, the storm moved over Labrador toward the ocean, and on the 25th it disappeared in the Arctic regions, west of Greenland.

VIII.—This disturbance appeared on the Pacific coast on the 21st, and was central near Visalia on that day; during the 22d and 23d the area moved east-northeastward and disappeared south of Montana.

IX.—This storm appeared in Dakota on the 23d, and, moving eastward through Minnesota, was central in Michigan on the 24th. During that day and the following, the depression moved over Canada to the Gulf of Saint Lawrence, where it was central on the 25th. On the 26th it was probably central near N. 50°, W. 50°, and on the 27th the s. s. "Rhyndland," in N. 50°, W. 40°, encountered strong west to northwest gales, with very low barometer. The storm continued its northeasterly movement, and on the 29th it disappeared in the Arctic regions to the northeast of Iceland.

X.—This area appeared in Nebraska on the 26th, and moved in a northeasterly direction toward Minnesota, where it was central on the morning of the 27th, the barometer at Saint Paul reading 29.68 (753.9), or 0.21 inch below the normal. On the 28th the centre of disturbance was in Wisconsin, and, moving thence northeastwardly, disappeared in British America.

XI.—This storm probably developed near N. 26°, W. 69°, on the 26th. The following vessel reports indicate the general features of the storm during the first part of its course. On the 26th the ship "Sunrise," in N. 26°, W. 69°, encountered a violent hurricane, in which she lost sails; on the same day the schooner "Lairg," in N. 25° 20', W. 70° 20', encountered a hurricane, commencing at northwest and backing to west and south-southwest, and on the 27th the wind moderated and shifted to east. The storm pursued a west-northwest course toward the Bahamas, and was encountered by the s. s. "Santiago," in N. 25° 50', W. 74° 10', that vessel reporting on the 27th, north-northwest hurricane with heavy northeast swell, barometer 29.80 (756.9); at midnight the wind shifted to southwest, with high sea, barometer reading 29.40 (746.7). On the 28th, the centre of disturbance was probably north of the Bahamas, the barometer at Nassau reading 29.76 (755.9), wind southwest. The s. s. "New Orleans" reported that the hurricane struck the vessel about 8 p. m. of the 28th, in N. 27°, W. 75°, when the sea rose in immense waves, and the wind blew from the northwest with terrific violence, backing to south and easterly; the hurricane lasted until 11 a. m. of the 29th. On the same day the s. s. "Morgan City," off the Florida coast, encountered a hurricane from west to southeast, lasting until the 29th. The storm reached the Florida peninsula on the 29th, the centre passing east and north of Key West; at Cedar Keys the wind reached a velocity of sixty-four miles per hour from the northeast. On the morning of the 30th, one vessel was dismasted and several buildings were blown down and otherwise damaged. The following vessel reports indicate the severity of the storm off the Florida coast. 30th, schooner "Hattie Haskell" encountered a hurricane in N. 30°, W. 76°, lasting thirteen hours; schooner "Annie Bell" was dismasted on the 29th, and on the same day the brig "Caroline Eddy," near Fernandina, had a strong northeast gale, in which the vessel was dismasted and



capsized. 30th, the bark "Felissa" was dismasted, thirty-four miles southeast of Cape Canaveral. The brig "John Roach" reported, gale commenced on the 28th, with wind from the north, and by the morning of the 29th it had increased to a hurricane, veering to northeast, east and southeast; the vessel was driven ashore sixteen miles south of Mosquito inlet (about N. 29°). The s. s. "City of Vera Cruz" foundered off the Florida coast, during this hurricane, with loss of all hands. The bark "Levanter," in N. 30° 30', W. 78° 40', had a heavy northeast gale veering to southeast, and lasting forty-eight hours. The captain of the schooner "Dora Ella" reported having passed nine wrecks between Jupiter inlet and Saint Augustine, and two between Point Derassa and Key West. On the 31st, the storm-centre moved slowly through Florida toward Alabama, where its influence was felt, the barometer at Mobile reading 29.47 (748.5) at the morning report of the 31st. This storm appears to have been sluggish in its progressive movement, but the persistency with which it remained over Florida and the coast indicated its dangerous nature. The effect of its presence was felt as far north as Wilmington and Cape Hatteras, North Carolina, the bark "Shooting Star," off Cape Lookout on the 29th, reporting high dangerous sea.

XI. (a)—This is a hurricane which probably developed south of N. 25° and east of W. 60°, and swept over Bermuda on the 29th and 30th. The reports of this storm are too indefinite to determine when and where it first appeared; the bark "Johnathan Chase," in N. 25° 18', W. 61° 00', reported a hurricane moving in a west-northwesterly direction on the 24th, and on the same day the ship "Queen of Scots," east of Bermuda, encountered a heavy northerly gale, backing to southeast by west and increasing to hurricane force, lasting until the 26th. The bark "Eliza White" reported a revolving gale, which commenced at southeast in N. 29°, W. 61°, during the 24th and 25th, and on the latter date the brig "M. A. Doran," in N. 25° 30', W. 62°, reported a heavy north-northeasterly to northwesterly gale, barometer rapidly falling from 30.40 (772.1) to 29.50 (749.3). These reports, if taken in connection with the storm under consideration, would seem to indicate that the Bermuda hurricane remained almost stationary for several days near N. 25° and W. 60°. On the 29th, the brig "Lorne," in N. 32° 40', W. 62° 40', had a hurricane from the north-northeast, afterward shifting to northwest, and the s. s. "Coronet," in N. 33°, W. 55°, had a hurricane from southwest to northwest, in which she stove bulwarks and split sails. At Bermuda, the hurricane was most severe between midnight of the 29th and morning of the 30th, doing much injury to buildings, trees, and small vessels; the barometer reached its lowest point, 29.14 (740.1), about 1 a. m. of the 30th. On the 31st, the bark "Carmella," in N. 33°, W. 63°, had a severe hurricane from east-southeast to northwest, lasting, with great violence, for fourteen hours, during which the vessel lost sails and sustained other damage. The brig "Twilight," on the 31st, in N. 38°, W. 62°, had a northerly, veering to southeasterly, gale with heavy sea; on September 1st, the gale increased, with wind from the northeast, and on the 2d and 3d, in N. 35°, W. 60°, was a complete hurricane from the northeast, vessel had decks swept, and sustained much damage; at midnight of the 3d, the storm abated, and on the 4th, the vessel was southwest of Bermuda, with fine weather and light southwest-erly winds.

In connection with the storms occurring over Europe, the following is given supplemented by notes from the "Monatliche Uebersicht der Witterung," published by Prof. Dr. G. Neumayer, Director of the German Marine Observatory at Hamburg:

XII.—This depression first appeared near the English channel on the 1st, and was probably central near Plymouth, the barometer at that station reading 29.65 (753.1), at the morning observation of that day. The disturbance crossed the North sea and moved in a northeasterly direction over northwestern Europe, the centre being near the southern shore of the Baltic

on the 2d. During that day and the 3d, the depression moved in a north-northeasterly course towards the Gulf of Bothnia, where it finally disappeared.

XIII.—This area appeared near Christiania on the 1st, barometer 29.28 (743.7); during the 2d and 3d, the disturbance passed in a north-northeasterly course through Sweden and disappeared over the Arctic ocean on the latter date.

XIV.—This low-area developed near Genoa on the 2d, and passed in a northeasterly course during the 3d and 4th, through Austria, where it developed considerable energy, being attended by stormy northwest winds and heavy rains; in the province of east Prussia, heavy floods occurred, causing much damage. On the 5th and 6th, the depression passed in a northerly direction across the Baltic and disappeared in Sweden.

XV.—This disturbance probably developed south of Iceland and moved northeasterly, the barometer at Thorshavn on the 6th, reading 29.36 (745.7). During the 7th, 8th, and 9th, the storm skirted the Norwegian coast and finally disappeared over the Arctic ocean.

XVI.—This area first appeared in Spain on the 5th, with its centre near Bilbao; barometer 29.74 (755.3). Moving in a course slightly to the south of east, the depression crossed the Mediterranean and was central west of Sardinia on the 6th; its course then changed to northeast, and the storm crossed Italy toward Austria on the 7th and 8th. On the latter date, it was probably central near Hermannstadt, and disappeared on the 9th.

XVII.—This storm probably developed south of Ireland on the 6th, and was the most severe of the month. On the 7th, the centre of disturbance was near St. Ann's Head; barometer 29.28 (743.7), wind west-southwest; the storm passed across England, and on the 8th was central over the North sea; it then passed northeasterly over Belgium and western Germany, causing much damage to shipping on the coasts of the North sea, and at many points on land. On the 9th, the disturbance moved toward the Baltic, where it disappeared. An area of relatively low pressure remained over Austria from the 10th to the 15th, causing very heavy rains in Austria and parts of Germany, the Danube reaching its highest summer level ever recorded during the present century.

XVIII.—This depression developed near the northwestern shore of the Black sea on the 16th, and moved northeasterly through Russia during the 17th, 18th, and 19th; disappearing in central Russia on the last-mentioned date.

XIX.—This disturbance developed in the Arctic regions, north of Norway or Finland, and moved in an east-southeasterly track across the White sea, and on the 22d, was probably central near Archangel; barometer, 29.67 (753.7). On the 23d, the disturbance disappeared in the valley of the Obi.

XX.—This developed over the Black sea on the 22d, and moved northeasterly through central Russia on the 23d, 24th, and 25th, the centre of disturbance being near Kasan on the 24th, the barometer at that station reading 29.47 (748.4), and on the 26th, the disturbance disappeared in the valley of the Obi.

XXI.—This area developed on the 31st near Lugan, and passed northeasterly over eastern Russia.

Of the storms appearing over eastern Asia, the following is given:

XXII.—This probably developed in China, north of Pekin, on the 10th, and moved eastwardly over Corea and the northern part of Nippon during the 11th and 12th, and disappeared over the ocean on the latter date.

XXIII.—This disturbance appeared in China on the 12th, and was central over the gulf of Pe-Chi-Li on the 13th. Moving northeasterly on the 14th, it crossed the sea of Japan and disappeared north of Nippon on that date.

XXIV.—This depression appeared in Tartary, near Vladivostock, on the 16th, and disappeared to the northward on the following day.

The following description of the four typhoons that occurred during the month of August, 1880, are taken from the "Bulle-

tin Mensuel," published by Mr. Marc Dechrevents, of the Zi-Ka-Wei observatory:

Of the four typhoons that swept the China sea during the month, two prevailed below the twentieth parallel of latitude and moved from east to west; the remaining two moved from south to north, from the twentieth to the fiftieth parallels. These typhoons appear to originate in the region situated to the east of the Philippine islands, between N. 10° and 20° and E. 140° and 150°, but owing to the small number of vessels frequenting that part of the ocean, it is impossible to definitely determine the region where they first develop.

The first typhoon of August (second of the season of 1880) entered the China sea by the channel which separates the islands of Formosa and Luzon, and was between the above-mentioned islands on the 28th of July. It pursued a westerly course, with a moderate and steady movement, and on the 31st it passed south of Hong-Kong. On August 1st, it crossed the island of Hainan, the gulf of Tonquin on the 2d, and entered the continent on the 3d, in about N. 18°. At Manilla, strong westerly to southwesterly winds prevailed, and at Hong-Kong the winds were northeasterly during the 30th and 31st of July, after which they shifted to east and southeast. At Pakhoi, on the northern coast of the gulf of Tonquin, the winds were northeasterly and moderate during July 31st and August 1st, but on the 2d, they changed to strong easterly, and on the 3d, they were southeasterly, blowing with great violence. At Zi-Ka-Wei, the winds were easterly, with no decided change in barometric pressure. The progressive rate of this typhoon may be estimated at about seven miles (eleven kilometres) per hour.

The second typhoon of August presents the form of a parabolic curve, with its apex to the north of the Yellow sea, and between Cape Shan-tung and Corea. Its progressive velocity, during the first part of its course, and until reaching the twenty-sixth parallel was very slow, being about 6 miles (10 kilometres) per hour, but its rate subsequently increased to about 19 miles (30 kilometres) per hour, between the fortieth and forty-fifth parallels of latitude. The following report of the bark "Laura R. Burnham" indicates the severity of the typhoon: At midnight of the 5th, the vessel was west of the centre, barometer 29.10 (739.0), wind north to northwest and blowing with terrific violence; the vessel lost sails, rudder, and sustained other damage and put into Nagasaki in distress, on the 11th. The ship "Mary Whitridge," which left Shanghai for Nagasaki on July 28th, was probably very near the centre, having reported on the 4th, barometer 28.50 (723.9). This typhoon was accompanied by heavy rains throughout its passage, and these were the only rains of the month at Cape Shan-tung and Newchwang.

The third typhoon (24th to 28th) traversed the entire archipelago of Japan. This disturbance moved more rapidly than the two just described, having in four days, moved from N. 25°, E. 125°, to N. 50°, E. 145°, with a steady velocity of about 19 miles (30 kilometres) per hour. This typhoon was very severe throughout Japan, the wind at Tokei reaching a velocity of 38 miles south, on the 25th, and the barometer at that station read 29.41 (747.0) on the same day. The U. S. steamer "Swatara," reported: At noon of the 25th, in N. 37° 19', E. 141° 30', barometer 29.79 (756.7) and falling; moderate south by west wind, of force 3. The barometer continued to fall and the wind increased in force until 6 p. m., when it shifted to south; at 9 p. m. the barometer read 29.66 (753.4), wind south by east, increasing to force 7; 10 p. m., barometer 29.62 (752.3), wind south-southeast, force 7 to 8; 11 p. m., barometer 29.58 (751.3), wind southeast by south, moderate gale, force 7 to 8, light rain. At midnight, the barometer read 29.54 (750.3), the wind blowing in heavy squalls from the southeast, force 7 to 9. The wind then backed to southwest, blowing a strong gale (9 to 10), and the barometer continued to fall until 4 a. m. of the 26th, when the lowest barometric reading was 29.44 (747.8). By noon of the 26th, the barometer began to rise and the wind decreased in force.

The fourth typhoon of August (fifth of the season of 1880), followed nearly the same course as that of July 31st, 1879, and is reported to have been, at Pakhoi, the most severe storm that had visited that place during a period of twenty-five years. The sugar-cane crop was greatly damaged and many junks were wrecked. The typhoon moved westward with a steady velocity of 7 miles (11 kilometres) per hour, and passed to the north of Hainan on the 31st. The lowest barometer reported by H. B. M's ship "Magpie," at Pochin Roads, China sea, during the passage of this disturbance, was 28.71 (729.3) on the morning of the 31st, the wind having moderated from northeast, force 12, to north, force 3.

#### OCEAN ICE.

June 21st to 24th: ship "E. J. Spicer," in N. 48° 50' to 45° 50', and W. 48° to 52°, passed a great number of icebergs, some of which were one hundred feet high.

28th: s. s. "Hermod," in N. 43° 50', W. 50°, observed two very high icebergs.

July 1st: bark "Walborg," in N. 44° 06', W. 48° 18', saw three icebergs.

4th and 5th: bark "Marie," in N. 44° 20', W. 46° 56', passed seven large icebergs, some of them fully five hundred feet high.

7th: s. s. "Matthew Bedlington," in N. 40°, W. 40° to 49°, passed through twenty large icebergs, with several smaller ones floating amongst them and very dangerous to navigation.

10th: bark "Elida," in N. 47° 48', W. 50° 45', passed seven icebergs, some of them very large, being about five hundred feet high.

13th: s. s. "Lord Gough," in N. 43° 31', W. 51° 32', passed three large icebergs.

15th: s. s. "Sophie," at New York reports: was surrounded by icebergs for eight days in N. 43° to 42°, and W. 49° 30', to 50° 30'. Some were one hundred feet high, melting and falling into the sea with a crashing sound. Saw no ice after reaching N. 41°.

16th: s. s. "Devon," off eastern edge of Banks, sighted large icebergs.

17th: bark "Johanne," in N. 46° 03', W. 48° 33', passed an iceberg.

19th: s. s. "Main," in N. 47° 45', W. 52° 12', passed an iceberg. In N. 46° 56', W. 52° 24', up to Sable, passed for a distance of 30 miles, numerous large icebergs, and in N. 46° 11', W. 53° 34', passed two large icebergs; s. s. "State of Nebraska," at New York reports under date, that she passed from N. 44° 32', W. 42° 13', to N. 44° 22', W. 48° 04', two large icebergs.

20th: bark "Johanne," in N. 45° 15', W. 48° 53', passed an iceberg.

23d: s. s. "Jason," in N. 45° 18', W. 47° 40', passed a large iceberg; bark "Johanne," in N. 43° 42', W. 51° 44', passed an iceberg.

#### TEMPERATURE OF THE AIR.

The distribution of mean temperature over the United States and Canada for the month of July, 1882, is exhibited by the dotted isothermal lines on chart ii. The table of mean temperatures at the lower left-hand corner on the chart shows the average temperature which prevailed in each district during the current month, compared with the mean temperature of each district, as determined from observations taken at Signal Service stations during the corresponding month of the past ten years.

During the month of July, the mean temperature has been below the normal in all districts except New England, the northern plateau, and in the middle and south Pacific coast regions, where the following slight departures occurred: +0°.4, +1°.1, +1°.0 and +0°.4, respectively. In the upper Mississippi valley, where the greatest departure occurred, the temperature has been 6° below the normal; and in the Ohio valley, Missouri valley, extreme northwest, upper lake region and east Gulf states, the departures have been 5°.1, 4°.9, 4°.6, 4°.2 and



Table of Comparative Maximum Temperatures for the Month of July.

State or Territory.	Maximum for July, 1882, Signal Service.		Highest since Signal Service stations were opened—3 to 11 years.			Highest from any other source.			
	Station.	Temp.	Station.	Temp.	Year.	Place.	Temp.	Year.	Length of Record.
Alabama	Mobile	96	Montgomery	107	1881	Mount Vernon Arsenal	104	1800?	33 years.
Arizona	Phoenix	114	Yuma	118	1878	Fort Mojave	119	1877	22 "
Arkansas	Fort Smith	100	Little Rock	100	'79 & '81	Washington, near	108	1860	28 "
California	Red Bluff	105	Red Bluff	110	1879	Fort Yuma	119	1877	31 "
Do						Fort Miller	118	1853?	13 "
Colorado	West Las Animas	99	Denver	102	1874	Fort Lyon	108	'08? & '78	22 "
Connecticut	New Haven and New London	90	New Haven	95	1876	New Haven	101	1864?	88 "
Dakota	Fort Sully	100	Fort Sully	100	1877	Fort Sully	114	1871	16 "
Delaware	Delaware Breakwater	88	Delaware Breakwater	91	1880	Fort Delaware	101	1865	45 "
Dist. of Columbia	Washington	85	Washington	102	1879	Washington	103	1838	40 "
Florida	Key West	85	Jacksonville	104	1879	Fort King	103	1833?	10 "
Georgia	Savannah	95	Augusta	105	1878	Forsyth	106	1881	7 "
Do			Savannah	105	1879	McPherson Barracks	105	1878	7 "
Idaho	Fort Lapwai	113	Fort Lapwai	104	1881	Fort Boise	113	1871?	15 "
Do			Boise City	106	1877				
Illinois	Chicago and Springfield	90	Cairo	99	'74 & '81	Chicago	106	1868	30 "
Do			Chicago	99	1874				
Do			Springfield	99	1874				
Indiana	Indianapolis	89	Indianapolis	101	1881	Wabash	104	1876	1 "
Do						Spiceland	100	'64 & '81	15 "
Indian Territory	Fort Supply	101	Fort Gibson	109	1879	Fort Sill	109	1871	10 "
Iowa	Des Moines	92	Des Moines	101	1874	Fort Arbuckle	109	1836	20 "
Do			Des Moines	101	1874	Fort Madison, near	105	1870	19 "
Kansas	Dodge City	101	Dodge City	108	1876	Brookside	105	1868	5 "
Kentucky	Louisville	91	Louisville	102	1874	Fort Larned	115	1871	17 "
Louisiana	Shreveport	100	Shreveport	107	1875	Newport Barracks	98		29 "
Maine	Portland	94	Portland	97	1876	Baton Rouge	102	'77 & '78	57 "
Do						Brunswick	102	1808	33 "
Maryland	Baltimore	93	Baltimore	99	'76? & '80	Fort Preble	101	1881	60 "
Do						Fort Washington	102	1853?	46 "
Massachusetts	Boston	98	Boston	101	1880	Fort McHenry	102	1879	51 "
Do						Westborough	103	1876	7 "
Michigan	Port Huron	91	Detroit and Marquette	100	1878	Fort Warren	100	1872	19 "
Do						Marquette	103	1862	9 "
Minnesota	Saint Paul	92	Saint Paul	99	1874	Monroe	103	1866	11 "
Do						Fort Ripley	103	1871	16 "
Mississippi	Vicksburg	96	Vicksburg	100	'78 & '81	Fort Snelling	100	1838	62 "
Do						Brookhaven	102	1880	7 "
Missouri	Springfield	98	Saint Louis	104	1881	Columbus	100	1862	10 "
Do						Allenton	109	1868	4 "
Do						Oregon	105	1868	10 "
Montana	Cartersville	106	Fort Keogh	109	1881	Saint Louis	103	1834?	38 "
Nebraska	North Platte and Omaha	93	North Platte	107	1877	Fort Shaw	112	1872	13 "
Nevada	Winnemucca	97	Winnemucca	104	1877	Fort McPherson	115	1870	15 "
New Hampshire	Mount Washington	90	Mount Washington	72	1881	Camp Halleck	110	1878	11 "
New Jersey	Little Egg Harbor	99	Sandy Hook	100	1876	Stratford	100	1868	11 "
New Mexico	Fort Bayard	115	La Mesilla	107	1880	Haddonfield	102	1866	7 "
Do	La Mesilla	107				Fort McRae	116	1873	10 "
New York	New York City	93	Oswego	100	1878	Fort Columbus	104	1821	60 "
Do						Newburg	103	1849	40 "
Do						Moriches	105	1868	6 "
North Carolina	Life Saving Station, No. 6	97	Wilmington	103	1879	Weldon	107	1879	8 "
Do	Kittyhawk	96				Fort Johnson	104	1831	67 "
Ohio	Cincinnati	90	Cincinnati	103	'79 & '81	Jacksonburg	104	1881	8 "
Do			Columbus	103	1881	Marietta	102	1859	54 "
Oregon	Umatilla	105	Umatilla	107	1880	Fort Dalles	105	1853	15 "
Pennsylvania	Philadelphia	94	Pittsburgh	103	1881	Carlisle Barracks	105	1868	39 "
Rhode Island	Narragansett Pier	89	Newport	92	1878	Fort Adams	102	1869	40 "
South Carolina	Charleston	94	Charleston	104	1879	Charleston	101	1752	105 "
Do						Stateburg	103	1881	1 "
Tennessee	Memphis	93	Chattanooga	101	1879	Castalian Springs	103	1875	3 "
Do			Nashville	101	'74 & '79				
Texas	Eagle Pass	111	Eagle Pass	112	1881	Fort Mason	114	1860	9 "
Do			Laredo	110	1879				
Utah	Salt Lake City	96	Salt Lake City	98	1877	Camp Douglas	103	1871?	20 "
Do						Mount Carmel	112	1877	3 "
Do						Kanab	107	1877	6 "
Vermont						Randolph	102	1868	5 "
Virginia	Cape Henry and Norfolk	95	Burlington	102	'76 & '79	Dover Mines, near	104	1879	3 "
Do			Norfolk	102		Snowville	102	1881	8 "
Do						Fortress Monroe	101	1881	56 "
Washington Ty.	Almota	105	Almota	103	1881	Fort Walla Walla	107	'59 & '60	13 "
Do			Dayton	102	1880	Cape Disappointment	104	1865	9 "
West Virginia	Morgantown	84	Morgantown	97	1874	Flemington	98	1881	1 "
Wisconsin	La Crosse and Milwaukee	88	La Crosse	101	1874	Embarras	104	1866	13 "
Wyoming	Fort Washakie	97	Cheyenne	100	1881	Fort Laramie	107	1876	27 "

4° 2, below the normal, respectively. Along the Atlantic coast, the departures have been less marked, and have ranged from 2° 2 below the normal in the south Atlantic states to 0° 4 above the normal in New England. At the station on the summit of Pike's Peak, the temperature has been 2° 5 below the mean of July.

#### DEVIATIONS FROM MEAN TEMPERATURE.

Under this heading, departures exhibited by the reports from the regular Signal Service stations are shown in the table of comparative temperatures on the left-hand side of chart ii. The following items of importance, in connection with this subject, are reported by voluntary observers:

**Illinois:** Riley, mean temperature, 65° 5, or 5° 5 below the average of the past twenty-one years, and 2° 4 below the mean of the coldest month (July, 1861,) for that period. The maxi-

um temperature for the month, 87°, is the lowest July maximum for the past twenty-one years. Swanwick, mean temperature of the month, 75° 7, is 4° 3 below the average July mean.

**Indiana:** Vevay, mean temperature 73° 9, or 4° 8 below the average of the past seventeen years. The maximum temperature for the month, 88°, is 8° 7 below the mean maximum, and the minimum, 57°, is 6° 9 below the mean minimum for the same period. Logansport, mean temperature 73° 6, or 6° below the average of the past twenty years. The maximum temperature, 92°, is 6° 8 below the mean maximum, and the minimum, 58°, is 0° 5 above the average minimum for the same period. The highest maximum temperature, 106°, occurred in 1874; lowest minimum, 46°, occurred in 1863.

**Iowa:** Clinton, mean temperature 68° 7, or 3° 4 below the average.

**Kansas:** Manhattan, mean temperature 72° 69, or 6° 38 below

the average July mean for a period of twenty-two years. Wellington, mean temperature 73°.05, or 6°.3 below the average of the past three years. The highest July mean for that period, 81°.2, occurred in 1879; the lowest is that of the present year. The minimum temperature of the month, 51°, is the lowest that has occurred during the past three years. Yates Centre, mean temperature, 73°.6, is 4°.4 below the average of the past two years.

*Maine:* Gardiner, mean temperature 67°.22, or 1°.6 below the average of the past forty-six years.

*Maryland:* Fallston, mean temperature 73°.62, or 2°.21 below the July mean of the eight years from 1872 to 1879, inclusive. During that period the highest monthly mean, 78°.73, occurred in 1872; the lowest, 74°.08, occurred in 1875.

*Missouri:* Saint Louis, "Missouri Weather Service" reports mean temperature below the average of the past forty-five years.

*New York:* North Volney, mean temperature 68°.6, or 1°.54 below the average of the past fourteen years. During that period, the highest July mean, 76°.16, occurred in 1868; the lowest, 66°.13, occurred in 1875.

*Vermont:* Woodstock, mean temperature 68°.52, or 0°.38 above the average of the past fifteen years. During that period the highest July mean, 71°.3, occurred in 1878, and the lowest, 64°.3, occurred in 1869; the highest maximum, 98°, occurred July 10th, 1881, and the lowest minimum, 40°, occurred July 6th, 1869.

*Virginia:* Wytheville, mean temperature, 67°.91, is the lowest July mean on a record covering a period of eighteen years. The maximum temperature of the month, 87°, is 10° below that of July, 1881, and is 4°.5 below the mean maximum temperature.

*West Virginia:* Helvetia, mean temperature, 66°.86, is 3°.85 below the average of the past six years, and is the lowest July mean for that period.

*Wisconsin:* Beloit, mean temperature, 68°.3, is the lowest July mean that has occurred since 1865.

#### RANGES OF TEMPERATURE AT SIGNAL SERVICE STATIONS.

Monthly ranges of temperature during the month of July varied at stations east of the Rocky mountains from 20° to 70°; and at stations west of that region from 21° to 74°. The smallest ranges are: Galveston, 20°; Indianola and San Francisco, 21°; Key West, New Orleans, Punta Rassa and San Diego, 22°; Cedar Keys, Jacksonville and Fort Macon, 23°; Cape May, Hatteras and Port Eads, 24°; Fredericksburg, Texas, 26°; Charleston and Wilmington, 27°; Savannah and Smithville, 28°; Delaware Breakwater, Pensacola, Pike's Peak, Morgantown, Starkville, and Life Saving Station, No. 6, North Carolina, 29°; Block Island, Rhode Island, 30°. The largest are: Fort Lapwai, Idaho, 74°; Cartersville, Montana, 70°; Deer Lodge, Montana, 67°; Colfax, Washington territory and Missoula, Montana, 64°; Fort Washakie, Wyoming, 63°; Terry's Landing, Montana, 62°; Grierson Springs, Texas, and Winnemucca, 61°; Fort Shaw, Montana, 59°; Pomeroy, Washington territory, 58°; Fort Keogh, Montana, and Lewiston, Idaho, 57°; Almota and Dayton, Washington territory, and Eagle Rock, Idaho, 56°; Umatilla, Oregon, and Forts Benton and Custer, Montana, 55°. The greatest daily ranges varied in the different districts as follows:

*New England:* From 15° on the summit of Mount Washington on the 16th, to 30° at Boston on the 27th.

*Middle Atlantic states:* From 15° at Cape May on the 17th, to 32° at Williamsport on the 23d.

*South Atlantic states:* From 17° at Fort Macon on the 6th and 7th, to 24° at Augusta on the 7th.

*Florida peninsula:* From 17° at Cedar Keys on the 16th, and at Key West on the 21st, to 19° at Punta Rassa on the 18th.

*East Gulf states:* From 15° at New Orleans on the 27th, to 27° at Montgomery on the 16th.

*West Gulf states:* From 16° at Galveston on the 18th, and

Table of Maximum and Minimum Temperatures for July, 1882.

State or Territory.	Signal Service.			U. S. Army Post Surgeons or Voluntary Observers.		
	Station.	Max.	Min.	Station.	Max.	Min.
Alabama.....	Mobile.....	96	6	Opelika.....	102	0
Do.....	Montgomery.....	96	61	Birmingham.....	102	45
Arizona.....	Phoenix.....	114	50	Texas Hill.....	118	
Arkansas.....	Fort Apache.....	100	61	Prescott.....	100	30
Do.....	Fort Smith.....	100	61	Bainley.....	117	44
California.....	Little Rock.....	105	52	Indio.....	101	36
Colorado.....	Red Bluff.....	99	49	Cisco.....	101	38
Do.....	Los Angeles.....	99	49	Fort Garland.....	96	55
Do.....	West Las Animas.....	99	49	Fort Buford.....	101	38
Do.....	Denver.....	99	49			
Do.....	Pike's Peak.....	90	54			
Connecticut.....	New Haven.....	90	54			
Do.....	New London.....	90	54			
Dakota.....	Fort Sully.....	100	40			
Do.....	Fort Meade.....	100	40			
Delaware.....	Del. Breakwater.....	88	59			
District of Columbia.....	Washington.....	93	58			
Florida.....	Key West.....	95	64	Live Oak.....	98	58
Do.....	Pensacola.....	95	64	Fort Gaines.....	101	50
Georgia.....	Savannah.....	95	64	Jesup.....	101	50
Do.....	Atlanta.....	113	39	Madison.....	101	50
Idaho.....	Fort Lapwai.....	113	39			
Do.....	Coeur d'Alene.....	113	39			
Illinois.....	Chicago and Springfield.....	90	32	Peoria.....	97	48
Do.....	Champaign.....	80	33	Riley.....	94	50
Indiana.....	Indianapolis.....	80	33	Fort Wayne.....	94	50
Do.....	Indianapolis.....	80	33	Lafayette.....	94	50
Indian Territory.....	Fort Supply.....	101	56			
Iowa.....	Des Moines.....	92	50	Clinton and Des Moines.....	94	46
Do.....	Dubuque.....	92	50	Nora Springs.....	101	40
Do.....	Dubuque.....	92	50	Creswell, Fort Riley and Wellington.....	101	40
Kansas.....	Dodge City.....	101	54	Manhattan.....	117	101
Do.....	Leavenworth.....	101	54	New Iberia.....	101	57
Do.....	Leavenworth.....	101	54	Franklin.....	101	57
Kentucky.....	Louisville.....	91	57	Alexandria and Amite City.....	101	57
Louisiana.....	Shreveport.....	100	64			
Do.....	Shreveport.....	100	64			
Do.....	Shreveport.....	100	64			
Maine.....	Portland.....	94	45	Fallston.....	95	54
Do.....	Eastport.....	93	59	Woodstock.....	102	48
Maryland.....	Baltimore.....	93	59	Somerset.....	102	48
Do.....	Baltimore.....	93	59	Heath.....	92	30
Massachusetts.....	Boston.....	98	52	Harrisville and Northport.....	92	30
Do.....	Thatcher's Island.....	91	52	Reed City.....	92	30
Michigan.....	Fort Huron.....	91	52			
Do.....	Alpena and Marquette.....	92	42	Meridian.....	104	50
Minnesota.....	St. Paul.....	92	42	Lake Sedalia.....	100	45
Do.....	St. Vincent.....	92	42	Pierce City.....	100	45
Mississippi.....	Vicksburg.....	96	62			
Do.....	Starkville.....	98	53			
Missouri.....	Springfield.....	98	53			
Do.....	Springfield.....	98	53			
Montana.....	Cartersville.....	106	33	Fort Niobrara.....	97	46
Do.....	Deer Lodge and New Chicago.....	93	45	Beowawe.....	108	38
Nebraska.....	North Platte.....	93	45	Halleck.....	94	48
Do.....	Omaha.....	93	45	Grafton.....	94	48
Nevada.....	Winnemucca.....	97	35	Fort Union.....	94	48
Do.....	Winnemucca.....	97	35			
New Hampshire.....	Mt. Washington.....	60	29			
Do.....	Mt. Washington.....	60	29			
New Jersey.....	Little Egg Harbor.....	99	51			
New Mexico.....	Fort Bayard.....	115	50			
Do.....	La Mesilla.....	107	50			
Do.....	Santa Fé.....	99	51			
New York.....	New York City.....	93	50	Fort Hamilton.....	97	45
Do.....	Rochester.....	93	50	Johnstown.....	97	45
North Carolina.....	Life-Saving Station No. 6.....	97	50	Wadesborough.....	105	54
Do.....	Life-Saving Station No. 6.....	97	50	Murphy.....	92	48
Do.....	Kittyhawk.....	96	60	Ruggles.....	92	48
Do.....	Charlotte.....	90	52	Westerville.....	95	44
Ohio.....	Cincinnati.....	90	52	Fallsington.....	95	44
Do.....	Toledo.....	105	42	Dyberry.....	90	51
Oregon.....	Umatilla.....	105	42	Fort Adams.....	100	49
Do.....	Roseburg.....	94	54	Georges.....	96	50
Pennsylvania.....	Philadelphia.....	94	54	Withe.....	96	50
Do.....	Philadelphia.....	94	54	Erin.....	96	50
Do.....	Erie, Pittsburgh, and Williamsport.....	94	54			
Rhode Island.....	Narragansett Pier.....	89	53	Promontory.....	110	38
South Carolina.....	Charleston.....	94	67	Coalville.....	94	46
Do.....	Charleston.....	94	67	Charlotte.....	94	46
Tennessee.....	Memphis.....	93	53	Woodstock.....	94	46
Do.....	Knoxville.....	93	53	Accotink.....	98	47
Texas.....	Eagle Pass.....	111	58	Wytheville.....	98	47
Do.....	Grierson Springs.....	96	46	Helvetia.....	86	47
Utah.....	Salt Lake City.....	96	46			
Do.....	Salt Lake City.....	96	46			
Vermont.....						
Do.....						
Virginia.....	Cape Henry and Norfolk.....	95	57			
Do.....	Fort Myer.....	105	38			
Washington Ter.....	Alamota.....	84	54			
Do.....	Colfax.....	84	54			
West Virginia.....	Morgantown.....	84	54			
Wisconsin.....	La Crosse and Milwaukee.....	88	50			
Do.....	Madison.....	88	50			
Do.....	Madison.....	88	50			
Wyoming.....	Fort Washakie.....	97	54	Fort Bridger.....	97	25



at Port Eads on the 31st, to 31° at San Antonio on the 31st and 32° at Fort Smith on the 23d and 24th.

*Rio Grande valley*: From 32° at Uvalde on the 4th and 6th, to 33° at Eagle Pass on the 7th.

*Ohio valley and Tennessee*: From 21° at Cincinnati on the 16th and 23d, to 32° at Pittsburgh on the 23d.

*Lower lake region*: From 24° at Detroit on the 6th and 22d, at Sandusky on the 24th, to 32° at Oswego on the 16th.

*Upper lake region*: From 20° at Chicago on the 1st, to 29° at Alpena on the 23d and 25th, and at Marquette on the 9th.

*Extreme northwest*: From 30° at Bismarck on the 2d and at Fort Stevenson on the 4th, 23d and 24th, to 33° at Moorhead on the 21st.

*Upper Mississippi valley*: From 21° at La Crosse on the 10th, to 31° at Dubuque on the 22d.

*Missouri valley*: From 27° at Omaha on the 8th, to 36° at Fort Bennett on the 27th.

*Northern slope*: From 32° at Helena on the 13th and 26th, and at North Platte on the 18th, to 48° at Fort Shaw on the 27th.

*Middle slope*: From 21° on the summit of Pike's Peak on the 10th and 27th, to 35° at Dodge City on the 10th.

*Southern slope*: From 26° at Henrietta on the 5th, to 38° at Coleman City on the 6th, and at Stockton on the 4th.

*Southern plateau*: From 28° at Fort Grant on the 18th, to 46° at La Mesilla on the 12th.

*Middle plateau*: From 34° at Pioche on the 10th, to 48° at Winnemucca on the 9th.

*Northern plateau*: From 39° at Lewiston on the 12th, to 51° at Missoula on the 26th and 30th.

*North Pacific coast region*: From 35° at Portland on the 15th, to 45° at Olympia on the 12th.

*Middle Pacific coast region*: From 19° at San Francisco on the 9th, to 36° at Sacramento on the 5th, and 38° at Red Bluff on the 13th.

*South Pacific coast region*: From 15° at San Diego on the 4th, to 31° at Yuma on the 10th, and 39° at Los Angeles on the 4th.

#### FROSTS.

Stations reporting the occurrence of frost are as follows:

Summit of Mount Washington, 2d and 3d.

New Chicago, Montana, 26th.

Cheyenne, Wyoming, 9th: heavy frost. 13th: Ranchmen report the occurrence of a heavy frost at Horse creek, thirty-five miles distant. The temperature at Cheyenne on this date was lower than on the 9th, when a heavy frost occurred.

Fort Washakie, Wyoming, 9th: Killing frost; potatoes very much injured.

Deer Lodge, Montana, 26th: Light frost.

Fort Garland, Colorado, 10th: Severe frost, doing much damage to potatoes.

Pagosa Springs, Colorado, 17th: Heavy frost; 10th, 11th, 16th, 31st, light frosts.

Fort Ellis, Montana, 8th: Heavy frost; 9th, 25th, light frosts.

Carson City, Nevada, 9th.

Neillsville, Wisconsin, 4th, 14th: Light frosts.

Summit of Pike's Peak, 1st, 3d, 4th, 25th: Light frosts; 16th, 22d, heavy frosts.

#### ICE.

Cheyenne, Wyoming, 9th: Ice formed in many places in this city and vicinity.

#### PRECIPITATION.

The distribution of rainfall in the United States and Canada during the month of July, as determined from observations taken at more than six hundred stations, is exhibited on chart number iii.

The table in the lower left-hand corner of the chart shows the average rainfall of July in each district, as determined from Signal Service observations during the past ten years,

and the actual rainfall during the current month, with excess or deficiency, as compared with the average.

There has been an excess of rainfall in the south Atlantic and Gulf states of from 1.41 to 1.95 inches, and in the extreme northwest, where it amounts to 1.56 inches. The largest excess of rainfall, 3.04 inches, has been reported from the southern slope, where unusually heavy monthly rainfalls for that region have occurred.

In the Ohio valley, lower lake region, the upper Mississippi and Missouri valleys deficiencies ranging from 1.11 to 1.74 inches are reported. Deficiencies of 0.98 inch and 0.63 inch occurred in New England and the middle Atlantic states, respectively. At the station on the summit of Mount Washington there was an excess of 2.86 inches, and on the summit of Pike's Peak a deficiency of 3.11 inches was reported.

#### DEVIATIONS FROM AVERAGE PRECIPITATIONS.

Under this heading, departures exhibited by the reports from the regular Signal Service stations are shown in the table of comparative monthly rainfalls (as published in the lower left-hand corner of chart iii). The following items of importance, in connection with this subject, are reported by voluntary observers:

*Illinois*: Riley, monthly rainfall, 3.63 inches, or 0.47 inch below the July average of the past twenty-one years.

*Indiana*: Logansport, monthly rainfall, 3.62 inches, or 0.83 inch less than the average of the past twenty years. During that period, the largest July rainfall, 13.10 inches, occurred in 1869; the smallest, 0.96 inch, occurred in 1863.

*Kansas*: Manhattan, monthly rainfall, 7.73, or 3.02 inches above the July average of the past twenty-two years. Wellington, monthly rainfall, 5.28, or 2.15 inches above the July average of the past three years. The total amount of rainfall for the annual rain period (April to July, inclusive,) of 1882 is 19.20, or 4.80 inches more than the average of the past three years. The total rainfall for the seven months ending July 31st is, 20.29, or 5.47 inches more than the average of the same period for the three preceding years.

*Maine*: Gardiner, monthly rainfall, 2.60 inches, or 0.76 inch below the average of the past forty-six years.

*Maryland*: Fallston, monthly rainfall, 3.04 inches, or 0.65 inch below the average of the past eleven years. During that period the largest July rainfall, 5.54 inches, occurred in 1873; the smallest, 1.42 inches, occurred in 1881.

*Massachusetts*: Worcester, monthly rainfall, 1.32, or 2.45 inches below the average. The total amount of rainfall for the seven months ending July 31st is 25.73 inches, or 0.30 inch less than the average of the same period in former years.

*Missouri*: Saint Louis, "Missouri Weather Service" reports monthly rainfall below the average of the past forty-five years.

*New Hampshire*: Antrim, monthly rainfall, 2.60, or 2.17 inches below the July average of the past ten years. Contoocookville, monthly rainfall, 1.65, or 2.35 inches below the average of the past twelve years. Grafton, monthly rainfall, 2.54, or 1.90 inches less than the average of the past three years.

*New York*: Troy, monthly rainfall, 9.62 inches, is more than 3.00 inches above the average of July for the past eight years. North Volney, monthly rainfall, 1.00 inch, or 2.96 inches below the average of the past ten years, and is the smallest July rainfall that has occurred during that period; the largest, 7.80 inches, fell in 1874.

*Pennsylvania*: Dyberry, monthly rainfall, 7.24 inches, is the largest that has occurred since July, 1871, when the amount was 7.68 inches.

*Virginia*: Wytheville, monthly rainfall, 4.63 inches, or 0.33 inch more than the average of a period of seventeen years. The precipitation for the seven months ending July 31st is 6.76 inches in excess of the average.

The following table shows the least and greatest numbers of rainy and cloudy days, and the percentages of mean relative humidity as reported from the various districts during the month:

Table of rainy and cloudy days and relative humidity for July, 1882.

Districts.	Rainy days	Cloudy days.	Relative humidity. *
	From 7 to 24	From 2 to 7	Percentages.
New England.....	8 " 22	3 " 5	61.9 " 81.3.
Middle Atlantic states.....	9 " 23	5 " 13	62.1 " 83.5.
South Atlantic states.....	14 " 23	4 " 7	60.6 " 74.1.
Florida peninsula.....	18 " 23	8 " 14	73.1 " 80.3.
East Gulf states.....	8 " 18	0 " 11	66.1 " 81.0.
West Gulf states.....	3 " 5	2 " 9	54.9 " 60.9.
Rio Grande valley.....	9 " 21	3 " 11	63.2 " 80.0.
Ohio valley and Tennessee.....	11 " 15	4 " 8	62.9 " 72.2.
Lower lake region.....	9 " 19	4 " 9	67.9 " 73.0.
Upper lake region.....	13 " 17	4 " 7	68.3 " 79.6.
Extreme northwest.....	10 " 15	4 " 8	63.8 " 78.4.
Upper Mississippi valley.....	9 " 16	1 " 9	60.2 " 73.7.
Missouri valley.....	5 " 11	1 " 4	44.1 " 67.7.
Northern slope.....	7 " 25	1 " 7	46.6 " 72.0.
Middle slope.....	5 " 14	0 " 6	44.6 " 71.9.
Southern slope.....	1 " 9	0 " 3	35.1 " 54.9.
Northern plateau.....	3 " 18	1 " 7	41.7 " 58.3.
Middle plateau.....	3 " 9	2 " 8	57.0 " 66.6.
North Pacific coast region.....	0 " 2	0 " 7	32.3 " 60.5.
Middle Pacific coast region.....	0 " 1	0 " 7	30.5 " 75.4.

\* Relative humidity corrected for altitude.

Table of Excessive, Greatest and Least Monthly Rainfalls.

STATION.	SPECIAL HEAVY.			Largest Monthly.	SMALLEST MONTHLY.	
	Date.	Amt.	Duration	Amount, Inches.	STATION.	Amt.
				inch.		
Alabama.					Arizona.	
State Line.....	18 and 19	3.05		16.37	Casa Grande.....	0.00
Do.....	22	2.80			Maricopa.....	0.00
Mt. Vernon Barracks.....	3 and 4	4.02		14.54	Texas Hill.....	0.00
Do.....	18 and 19	3.44			Wilcox.....	0.11
Scottsborough.....				9.40	Yuma.....	0.20
Mobile.....				9.52	Phoenix.....	0.32
Uniontown.....				9.49	San Simon.....	0.30
Demopolis.....				7.85	California.	
Troy.....				7.84	Alta.....	0.00
Selma.....				6.64	Alcatraz Island.....	0.00
Tusculum.....				6.49	Anaheim.....	0.00
Montgomery.....	11 and 12	4.70		6.29	Angel Island.....	0.00
Decatur.....	3	2.61		6.19	Antioch.....	0.00
Arkansas.					Auburn.....	
Helena.....				7.43	Benetia Barracks.....	0.00
Russellville.....	3	3.40			Berryvale.....	0.00
Canada.					Brentwood.....	
Montreal.....				6.04	Brighton.....	0.00
Dakota.					Borden.....	
Huron.....	29	2.06	2 hrs.		Byron.....	0.00
Delaware.					Caliente.....	
Delaware Breakwater.....	29	2.00	6 hrs.		Calistoga.....	0.00
Florida.					Calsco.....	
Mayport.....	4 and 5	3.03		11.10	Colton.....	0.00
Do.....	8 and 9	3.98			Davis.....	0.00
Live Oak.....				10.98	Delano.....	0.00
Fort Brook, Tampa.....	21	2.30	3hrs.10m.	10.44	Dunnigan.....	0.00
Cedar Keys.....	3 and 4	3.96		10.33	Emigrant Gap.....	0.00
Do.....	24	3.43	6hrs.50m.		Fresno.....	0.00
Fort Barrancas.....	3 and 4	3.19		9.22	Galt.....	0.00
Fernandina.....				8.48	Goshen.....	0.00
Waldo.....				7.68	Hollister.....	0.00
Pensacola.....	11	2.33	6hrs.45m.	7.62	Indio.....	0.00
Key West.....	10	1.40	1hr.30m.		Lone.....	0.00
Georgia.					Keene.....	
Way Cross.....	21 and 22	3.79		11.37	Kingsburg.....	0.00
Columbus.....				9.02	Lathrop.....	0.00
Thomasville.....	2 and 3	3.50		8.81	Lemoore.....	0.00
Fort Gaines.....				7.41	Livermore.....	0.00
Newnan.....				7.41	Los Angeles.....	0.00
West Point.....				6.80	Mammoth Tank.....	0.00
Smithville.....				6.67	Martinez.....	0.00
Madison.....				6.65	Marysville.....	0.00
Atlanta.....	3	1.80	3hrs.10m.	6.61	Menlo Park.....	0.00
Cartersville.....	3	2.50		6.48	Merced.....	0.00
Calhoun.....				6.42	Modesto.....	0.00
Indiana.					Mojave.....	
Evansville.....				6.06	Napa.....	0.00
Indian Territory.					Newhall.....	
Fort Supply.....	21	2.66		6.80	Niles.....	0.00
Iowa.					Oakland.....	
Logan.....				7.30	Petaluma.....	0.00
Davenport.....	9	1.17	1hr.10m.		Point San Jose.....	0.00
Kansas.					Poway.....	
Fort Riley.....	27 and 28	3.84		8.61	Ravenna.....	0.00
Manhattan.....	27, 28, & 29	4.95		7.73	Redding.....	0.00
Clay Centre.....				7.04	Salinas.....	0.00
Holton.....				6.06	San Mateo.....	0.00
Kentucky.					San Francisco.....	
Paducah.....	1	3.61		7.89	San Fernando.....	0.00
Louisiana.					San Diego.....	
Port Ends.....	25 and 26	4.70		13.68	Santa Cruz.....	0.00
Shreveport.....	18	2.83		11.38	San Jose.....	0.00
Cheneyville.....	27	3.15		11.35	Spadra.....	0.00
Amite City.....				11.27	South Valejo.....	0.00
Scranton.....	23	3.06		9.98	Suisun.....	0.00
Waterville.....				8.61	Summer.....	0.00
Monroe.....				7.66	Stockton.....	0.00
Alexandria.....				7.36	Solidad.....	0.00
Natchitoches.....	16 and 17	3.42		7.02	Tehama.....	0.00

Table of Excessive, Greatest and Least Monthly Rainfalls—Continued.

STATION.	SPECIAL HEAVY.			Largest Monthly. Amount, Inches.	SMALLEST MONTHLY.	
	Date.	Amt.	Duration		STATION.	Amt.
New Iberia.....				6.99	Tehachapi.....	0.00
New Orleans.....	16	1.30	55 m.	6.84	Tracy.....	0.00
Morgan City.....				6.52	Tulare.....	0.00
Maryland.....					Turlock.....	0.00
Baltimore.....	29	1.50	2 hrs.		Whitewater.....	0.00
Massachusetts.....					Williams.....	0.00
Milton.....	28	2.00	1 hr.		Willows.....	0.00
Michigan.....					Woodland.....	0.00
Fort Brady.....	27	1.20	1hr. 45m.		Red Bluff.....	t'ce
Minnesota.....					Sacramento.....	t'ce
Northfield.....	25 and 26	3.12		7.25	Princeton.....	0.01
Mississippi.....					Waugh's Ferry.....	0.02
Lake.....	11 and 12	4.60		14.32	Pleasanton.....	0.04
do.....	22	2.52			Fort Gaston.....	0.06
Brookhaven.....				10.31	Fort Bidwell.....	0.16
Vicksburg.....				10.19	Colorado.....	
Edwards.....				10.11	Hermosa.....	0.30
Jackson.....				9.10	Idaho.....	
Batesville.....	20 and 21	3.57		8.48	Coeur d' Alene.....	t'ce
Meridian.....	22	3.00		6.72	Lewiston.....	0.29
Macomb.....				6.32	Eagle Rock.....	0.30
Starkville.....				6.08	Montana.....	
Aberdeen.....				6.02	Terry's Landing.....	0.15
Missouri.....					Fort Maginnis.....	0.19
Protem.....	11 and 12	1.80	1hr. 30m.	8.41	Helena.....	0.36
Pierce City.....	21	2.20	6hrs. 21m.	8.20	Nevada.....	
Nebraska.....					Browns.....	0.00
Clear Creek.....				7.79	Humboldt.....	0.00
Omaha.....				6.76	Tecoma.....	0.00
Freemont.....				6.45	Tonno.....	0.00
New Hampshire.....					Winnemucca.....	0.01
Mount Washington.....	2	2.71		10.03	Halleck.....	0.03
New Jersey.....					Goldconda.....	0.06
Paterson.....				7.02	Battle Mountain.....	0.08
New York.....					Carson City.....	0.18
Troy.....	28	3.28		9.62	Carlin.....	0.18
White Plains.....	2	2.45	1hr. 35m.	6.12	Beowawe.....	0.20
North Carolina.....					Pioche.....	0.21
Kittyhawk.....	13	2.66		15.36	Hot Springs.....	0.35
do.....	19	3.23	5hrs. 25m.		Otega.....	0.44
do.....	20	2.15	2hrs. 19m.		Oregon.....	
do.....	21	2.45			Umatilla.....	0.04
Goldboro.....				9.49	Utah.....	
Wilmington.....				8.89	Corinne.....	0.00
Murphy.....				8.20	Ogden.....	0.00
Hatteras.....				7.26	Promontory.....	0.00
Charlotte.....	30	2.08	3hrs. 15m.		Coolville.....	0.06
Pennsylvania.....					Salt Lake City.....	0.30
Dyberry.....	12	1.51	2 hrs.	7.24	Washington.....	
do.....	1	2.50	16 hrs.		Colfax.....	0.30
Blooming Grove.....				6.20	Wyoming.....	
Erie.....	18	1.42	35 min.		Fort Bridger.....	0.32
South Carolina.....						
Hardeeville.....	22	2.55		10.62		
Florence.....				10.31		
Cheraw.....	22	3.85		7.44		
Columbia.....				7.04		
Yennassee.....	22	3.60		6.94		
Georges.....				6.32		
Jacksonborough.....	22	3.00				
Tennessee.....						
Austin.....				9.40		
Erin.....				6.74		
Millan.....	17	3.20		6.62		
Knoxville.....				6.25		
Harris.....	17	2.48				
Texas.....						
Jacksboro.....	29	5.06		10.51		
Graham.....				9.26		
Weatherford.....				7.08		
Palestine.....				7.01		
Dallas.....				6.96		
Coleman City.....	22	2.80	4 hrs.	6.61		
Tyler.....	9	2.80		6.61		
Decatur.....				6.52		
Denison.....				6.32		
Clarksville.....				6.91		
Eagle Pass.....	10	3.04	2hrs. 30m.			
Fredericksburg.....	19	1.56	1 hr. 30m.			
West Virginia.....						
Helvetia.....				7.63		
Wellsburg.....	1	1.00	1 hr.			

\* June 30 and July 1.

## HAIL.

Fort Bennett, Dakota, 14th: Severe hail storm; stones of size of walnuts.

Fort Supply, Indian territory, 4th: Severe hail storm; hail-stones of unusually large size.

Pike's Peak, Colorado, 12th: Heavy hail storm occurred about 4.00 p. m. The hail-stones were one inch in diameter and of a balloon shape, and were very hard. Hail storms were also reported on the 2d, 3d, 23d, and 28th.

Hastings, Nebraska, 11th: Heavy hail storm occurred, causing much damage to crops and fruit gardens, and breaking many windows. The hail-belt extended about a mile west and north of the town, and somewhat farther eastward.



Sterling, Kansas, 15th: A severe hail storm occurred in Rice county, many windows were broken, and crops were damaged.

Santa Fé, New Mexico, 14th: At Cerrillos mining camp, about twenty miles from Santa Fé, a heavy hail storm prevailed; windows were broken, and several persons injured. Much damage was done to gardens and crops.

Hail storms of less violence have occurred in the various states and territories, as follows:

Colorado: Fort Garland, 14th.

Dakota: Fort Lincoln, 2d; Fort Hale, 15th; Fort Meade, 18th; Alexandria, 9th; Fort Stevenson, 17th and 25th; Rapid City, 18th.

Illinois: Riley, 13th; Swanwick, 13th.

Idaho: Eagle Rock, 21st.

Kansas: Wellington, 15th; Yates Centre, 11th.

Michigan: Hastings, 4th; Grand Haven, 4th; Port Huron, 18th.

Missouri: Pierce City, 3d; Saint Louis, 13th; Saint Joseph, 18th.

Montana: Helena, 5th and 16th.

Nebraska: Fremont, 27th.

New Mexico: Fort Union, 17th and 28th; Fort Bayard, 27th; Santa Fé, 14th and 24th.

New York: Menand's road, near Albany, 28th; Albany 28th.

Ohio: Westerville, 5th; Cleveland, 18th.

Pennsylvania: Pittsburg, 14th.

South Carolina: Columbia, 1st.

Tennessee: Nashville, 29th.

Texas: Fort McKavett, 19th; Concho, 9th.

Utah: Salt Lake City, 21st.

Wisconsin: Franklin, 21st.

Wyoming territory: Cheyenne, 28th.

#### SNOW.

Snow is reported to have fallen at the following stations during the month:

Summit of Mount Washington, 2d, 3d.

Summit of Pike's Peak, 20th, 24th, 25th, 26th.

Fort Ellis, Montana, 8th.

#### SLEET.

Mount Washington, 3d; Pike's Peak, 8th, 13th to 16th, 22d, 26th, 27th, 30th.

#### COTTON REGION REPORTS.

The following tables give the average rainfall, mean of maximum and mean of minimum temperatures, for the months of July, June, May, and April, in each of the cotton districts as shown on chart vi. issued with the April REVIEW.

Meteorological Record for the Cotton Districts for the month of July 1882.

DISTRICTS.	Average rainfall in inches.	Mean of the maximum.	Mean of the minimum.
New Orleans.....	8.30	90.4	71.3
Savannah.....	6.21	91.0	70.3
Charleston.....	7.25	90.9	68.0
Atlanta.....	5.45	87.9	67.6
Wilmington.....	5.90	90.2	67.7
Memphis.....	5.45	88.0	67.1
Galveston.....	3.74	94.0	71.3
Vicksburg.....	10.30	89.4	69.0
Montgomery.....	5.19	88.6	67.1
Augusta.....	4.93	90.0	69.2
Little Rock.....	3.08	89.2	66.0
Mobile.....	6.06	90.5	68.7

Meteorological Record for the Cotton Districts for the month of June, 1882.

DISTRICTS.	Average rainfall in inches.	Mean of the maximum.	Mean of the minimum.
New Orleans.....	2.43	90.6	72.5
Savannah.....	4.97	89.9	70.4
Charleston.....	4.98	89.9	67.5
Atlanta.....	3.85	88.6	66.8
Wilmington.....	1.97	90.0	66.2
Memphis.....	2.89	90.4	67.0
Galveston.....	0.90	92.7	70.0
Vicksburg.....	1.44	91.2	68.5
Montgomery.....	3.49	91.5	68.4
Augusta.....	4.06	90.5	67.6
Little Rock.....	1.58	91.3	64.2
Mobile.....	2.60	94.5	68.5

Meteorological Record for the Cotton Districts for the month of May, 1882.

DISTRICTS.	Average rainfall in inches.	Mean of the maximum.	Mean of the minimum.
New Orleans.....	5.57	84.4	61.1
Savannah.....	2.59	84.8	60.7
Charleston.....	2.53	81.9	58.1
Atlanta.....	2.39	78.9	56.2
Wilmington.....	2.52	79.0	54.6
Memphis.....	7.58	77.7	56.3
Galveston.....	5.25	83.9	59.9
Vicksburg.....	7.03	81.9	60.8
Montgomery.....	3.02	81.9	58.2
Augusta.....	2.11	82.2	57.8
Little Rock.....	11.04	78.7	53.6
Mobile.....	4.69	83.4	58.3

Meteorological Record for the Cotton Districts for the month of April, 1882.

DISTRICTS.	Average rainfall in inches.	Mean of the maximum.	Mean of the minimum.
New Orleans.....	5.63	81.9	59.9
Savannah.....	3.73	81.1	60.2
Charleston.....	2.66	77.5	54.5
Atlanta.....	4.49	76.3	54.9
Wilmington.....	3.88	74.2	50.0
Memphis.....	5.29	74.9	54.0
Galveston.....	1.58	82.1	57.9
Vicksburg.....	7.03	75.6	56.8
Montgomery.....	4.92	78.5	57.2
Augusta.....	3.05	78.2	54.7
Little Rock.....	4.74	75.9	51.9
Mobile.....	8.80	79.1	57.3

#### WINDS.

The prevailing winds at Signal Service stations during the month of July, 1882, are shown on chart number ii. by arrows, which fly with the wind.

Throughout the country east of the Rocky mountains the prevailing winds were mostly southerly, except along the coast of New England, where they were westerly, and in the northern and middle slopes, where they were westerly and northwesterly; along the immediate California coast they were westerly; in the southern and middle plateau districts they were from southeast to southwest; in the northern plateau and in the north Pacific coast region they were variable.

#### TOTAL MOVEMENTS OF THE AIR.

The following are the largest total movements of the air at Signal Service stations: Mount Washington, New Hampshire, 25,082 miles; Hatteras, North Carolina, 11,318; San Francisco, California, 9,550; Fort Macon, North Carolina, 9,083; Galveston, Texas, 8,946; Dodge City, Kansas, 8,845; Indianola, Texas, 8,703; Eagle Rock, Idaho, 8,555; Delaware Breakwater, 8,452; Kitty Hawk, North Carolina, 8,437; Sandusky, Ohio, 8,143.

The smallest are: La Mesilla, New Mexico, 1,423; Lynchburg, Virginia, 1,910; Nashville, Tennessee, 2,217; Roseburg, Oregon, 2,258; Olympia, Washington territory, 2,269; Uvalde, Texas, 2,377; Silver City, New Mexico, 2,458; Morgantown, West Virginia, 2,571; Augusta, Georgia, 2,577; Vicksburg, Mississippi, 2,627; Tucson, Arizona, 2,776; Dayton, Washington territory, 2,877; Washington, District of Columbia, 2,903.

#### HIGH WINDS.

The highest velocity reported during the month (92 miles per hour, from the nw.) occurred on the summit of Mount Washington on the 2d. Other days on which high velocities were recorded, at this station, are as follows: 52 miles, s., 1st; 68, nw., 3d; 70, ne., 5th; 64, nw., 6th; 68, nw., 7th; 52, nw., 8th; 62, nw., 9th; 53, w., 10th; 68, nw., 11th; 71, nw., 12th; 70, nw., 13th; 50, w., 17th; 51, nw., 19th; 52, nw., 21st; 52, nw., 22d; 58, nw., 23d; 60, nw., 24th; 56, nw., 25th; 60, nw., 26th; 62, nw., 27th; 52, nw., 28th; 51, nw., 29th.

Velocities of fifty miles per hour, or more, were also reported from the following stations: Little Rock, Arkansas, 54, n., 4th; Fort Bennett, Dakota, 52, nw., 15th; Fort Stevenson, Dakota, 50, se., 24th.

#### LOCAL STORMS.

Arkansas: 3d, a tornado occurred in Crawford county, caus-

ing loss of three lives and much valuable stock, near Van Buren. Little Rock, 3d, a severe storm burst over the city; many houses were blown down and unroofed; the wind reached a velocity of fifty-four miles per hour, and for ten minutes, it blew at the rate of sixty-six miles per hour. On the 12th, a storm of short duration occurred, several buildings in the suburbs were unroofed and otherwise damaged. Texarkana, 12th, a severe hurricane passed over this place about 7 p. m. A large three story building was blown over, falling upon a frame building in which a number of persons had congregated; more than twenty persons were buried in the ruins. Several sheds and out-buildings were destroyed, and considerable damage was done to other property in the town.

*Colorado:* A severe storm occurred at Manitou, El Paso county, on the 1st. The storm was accompanied by hail and torrents of rain; bridges, fences, and trees were carried away, and houses standing on the banks of the streams were flooded, or swept away. Many houses in Manitou were more or less damaged, and the loss of horses and cattle amounted to several thousand dollars.

*Delaware:* During a heavy gale at Delaware Breakwater on the 4th, the schooner "Eden" lost mainmast.

*Dakota:* On the 14th, a violent storm of wind, hail, and rain, swept over the Redwater and Spearfish valleys, in Lawrence county. The path of the storm was about four miles wide, and moved in a northerly direction for a distance of about thirty miles. All the crops in the track of the storm, were destroyed; it is estimated that crops covering an area of 2,000 acres were entirely destroyed.

*Iowa:* A tornado appeared near Nora springs about 5.30 p. m. of the 17th. The tornado cloud was funnel-shaped, and appeared to be several hundred feet high. It first struck the earth near Shell Rock river, and took a northeasterly path through an adjoining farm, tearing up crops and fences, and injuring barns and other property. The width of the storm-path was about two rods. After leaving Nora Springs the tornado passed into Mitchell county.

*Kansas:* A tornado swept through Cherokee and Crawford counties about 5.30 p. m. of the 5th, and was accompanied by large hail and heavy rain, and caused great damage to crops and property. Trees were uprooted and stacked grain was scattered in all directions. Near Columbus several houses and barns were completely demolished, and many others were unroofed or otherwise damaged; several persons were injured, some severely. In Crawford county houses, barns, fences and crops were laid low, and several persons were severely injured. A very heavy wind storm passed over Marysville, Marshall county, at 10 a. m. of the 11th; telegraph wires were prostrated, and much damage resulted to the town. At Waterville several barns and dwellings were blown down, and stacked grain was scattered. The storm passed eastward into Nemaha county and was accompanied by heavy hail; at Centralia a school house was unroofed and a church steeple badly damaged; two large barns were blown down, and several houses were more or less damaged. The fruit crop suffered severely. Atchison, 11th, a tornado visited this place at about 11 a. m., and was probably a continuation of the storm above referred to. Houses and barns were blown down, and trees, fences and signs were carried away; at Farmington, fruit and corn were cut down and several buildings were leveled. At Effingham, chimneys, out-houses, fences and trees were generally leveled, and in the surrounding country several farm houses were more or less damaged, the inmates receiving, in some cases, severe injury. A tornado occurred in Pratt county on the night of the 12th. Five houses were blown down at Iuka, and several other buildings were badly damaged; in the country many barns were blown down, several persons were injured—some fatally—and the crops were destroyed in a belt of country four miles wide. A tornado also appeared in Rice county on the 16th; the storm struck Eureka township, where it did much damage, carrying away wheat stacks and unroofing dwellings. Near Kansas Centre the storm was very severe, several farm

houses being demolished, and the crops entirely destroyed. The loss in the county amounted to several thousands of dollars.

*Missouri:* A destructive wind and rain storm visited Saint Joseph at noon of the 11th. Many buildings were damaged and trees uprooted and broken, and several workmen were injured by being blown off the buildings in course of construction. The storm lasted twenty minutes, being followed by heavy rain. Independence, 11th, a tornado cloud, accompanied by strong wind and heavy thunder and lightning, passed over the town; it was followed by heavy rain, but no damage was done. At Protem, a severe storm occurred at 11.35 p. m. of the 11th, fields of corn were leveled to the ground, and much damage was done to orchards, many trees being uprooted. A heavy rain and thunder storm occurred at Springfield on the 11th, the wind reaching a velocity of forty-eight miles per hour. The damage to the city was slight.

*Minnesota:* During the evening of the 25th, a severe storm accompanied by loud thunder and vivid lightning, occurred at Saint Paul. Two unfinished buildings in the city were demolished, and a portion of the railing of the bridge spanning the Mississippi river was blown off, and many trees were uprooted. Reports from the surrounding country stated that the storm was very severe.

*Nebraska:* A destructive storm passed over southwestern Nebraska on the morning of the 11th, and was accompanied by heavy hail, which caused great damage to crops. The wind in some places attained the force of a hurricane, and at Hastings, Adams county, many buildings were unroofed, and a large number of windows were broken by the large hail-stones. At Glenville, Clay county, several houses were blown down, and the depot of the Saint Joseph and Western railroad was demolished.

*North Carolina:* 28th, a tornado occurred at Nag's Head, ten miles south of Kittyhawk; the hotel was partially unroofed; heavy timbers were taken up and carried some distance.

*Ohio:* Cincinnati, 4th, during a heavy wind storm, several houses in the suburbs were unroofed and chimneys blown down; but no damage occurred in the city. A wind and rain storm passed over Marietta on the night of the 10th; corn was broken down, and more or less damage resulted to property.

*Pennsylvania:* 15th, a storm occurred during the evening, in Allegheny county; fences and trees were blown down, and a tow-boat was capsized. On the afternoon of the 19th, a heavy wind and rain storm passed over the northern section of Lancaster county. In Columbia, trees and signs were blown down and the streets were obstructed by debris. Much damage was done to boats on the canal, and several persons were injured by flying debris.

*Texas:* A severe storm occurred at Jacksboro, about midnight of the 17th. Four buildings were unroofed, and the iron roof of the jail was blown off. The wind reached a velocity of fifty-four miles per hour. A violent storm of wind and rain occurred in Travis county, about ten miles north of Austin, on the afternoon of the 20th. Houses and barns were unroofed, and the corn and cotton crops in the track of the storm were destroyed. On the 21st, a heavy wind storm also occurred in Shackelford county, damaging one building and uprooting hundreds of trees.

## VERIFICATIONS.

### INDICATIONS.

The detailed comparison of the tri-daily indications for July, 1882, with the telegraphic reports for the succeeding twenty-four hours, shows the general average percentage of verifications to be 90.5 per cent. The percentages for the four elements are: Weather, 92.6; Direction of the Wind, 89.2; Temperature, 90.6; Barometer, 89.8 per cent. By geographical districts they are: For New England, 91.0; middle Atlantic states, 91.8; south Atlantic states, 91.4; east Gulf states, 92.2; west Gulf states, 92.5; lower lake region, 91.1;



upper lake region, 88.7; Tennessee and the Ohio valley, 90.7; upper Mississippi valley, 90.0; lower Missouri valley, 86.5; northern Pacific coast region, 83.3; middle Pacific coast region, 90.3; southern Pacific coast region, 90.3.

There were 50 omissions to predict (13 being due to the absence of reports from the Pacific coast) out of 3,813, or 1.31 per cent. Of the 3,763 predictions that have been made, 29, or 0.77 per cent., are considered to have entirely failed; 64, or 1.70 per cent., were one-fourth verified; 232, or 6.17 per cent., were one-half verified; 645, or 17.14 per cent., were three-fourths verified; 2,793, or 74.22 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

#### CAUTIONARY SIGNALS.

Seven cautionary signals were displayed during the month of July, of which the total number, or 100 per cent., were justified by winds of twenty-five miles per hour, at or within one hundred miles of the station. No off-shore signals were displayed.

One-hundred and fifteen winds of twenty-five miles, or more, per hour, were reported, for which no signals were ordered; many of these were local storms or strong sea-breezes, for which no signals were required. One Signal was reported late.

#### NAVIGATION.

##### STAGE OF WATER IN RIVERS.

In the table on the right-hand of chart number iii., are given the highest and lowest stages of water observed at Signal Service stations during the month of July, 1882. In the first column of this table are given the heights of water on the gauge, which have been dangerous to property at stations.

The upper Mississippi river, from Keokuk to Cairo, reached its highest stage between the 1st and 9th. At the former station, on the 1st, the water rose to fifteen feet and seven inches, or thirteen inches above the danger line. At Saint Louis, the highest water, thirty-two feet and five inches, or twenty-five inches above the danger line, occurred on the 5th. On the 8th and 9th, at Cairo, the water rose to within fourteen inches of the danger line. At Vicksburg, the river continued falling throughout the month. The water remained at the danger line on the 1st and 2d; and at the close of the month was five feet and nine inches below the danger line. The highest water in the Missouri river occurred from the 1st to the 3d; and in the Ohio river, from the 1st to the 8th.

#### FLOODS.

**Missouri:** Kansas City, 2d, the Missouri river overflowed its banks and completely flooded the surrounding country, doing severe damage to crops. In many places farmers left their homes, fearing a general washout. The damage to crops is estimated at \$50,000. Protem, 3d, heavy rains caused an overflow in Bear and Bee creeks, Boone county. A thickly settled farming region was flooded; fields of corn and cotton were destroyed, fences swept away, and a quantity of shocked wheat was seriously damaged. 8th, a creek about twenty miles south of Protem overflowed from the effects of a heavy rain; horses, cattle and crops were swept away and lost.

Saint Louis, during the 3d, 4th and 5th the Mississippi river was from one foot, six inches to two feet, five inches above the danger-line. Large tracts of bottom-lands were submerged, and lumber-yards and other property along the river suffered considerable damage. The damage to crops is estimated at \$20,000.

Saint Joseph, 18th, heavy rains caused damaging floods, which swept away many small buildings, and caused damage to sewers and other city property to the amount of \$5,000. Much damage also occurred to shocked wheat and to the oat crop, which was ready to harvest.

**Ohio:** Lebanon, 10th, a flood in Turtle creek caused damage to four houses situated on the banks of the creek, and the furniture was swept away and lost. Columbus, 10th, during a

heavy rain-storm cellars in the northern part of the city were flooded.

**Illinois:** Alton, 1st, a rise in the Mississippi river caused floods in bottom lands, and ruined many fields of wheat. Several buildings near the river front were damaged.

**New York:** New York City, 5th, a heavy rain storm flooded the streets and cellars in some sections of the city.

**Massachusetts:** Boston, 19th, the basements of many houses were flooded during a very heavy rain storm on the afternoon of the above date.

**Texas:** Coleman City, 9th, a heavy rain caused the creek to rise fifteen feet; bottom-lands were flooded and fences carried away; vegetable crops were much damaged.

#### TEMPERATURE OF WATER.

The temperature of water as observed in rivers and harbors at Signal Service stations, with the average depth at which observations were taken, is given in the table on the right-hand of chart number ii. In the first column of the table is given the maximum temperature observed during the month; and in the second column the minimum temperature observed during the same period.

The following table gives the highest and lowest temperature of water at the several stations, with the range of water temperature, mean temperature of the air at the station, and the depth of water at which the observations were taken. It will be seen that the greatest ranges are as follows: 18° at Chincoteague; 17° at New Haven; 15° at Newport; 15° at Duluth. The smallest are: 3° at Port Eads; 4° at Smithville; 4° at Savannah; 5° at Baltimore:

Temperature of Water for July, 1882.

STATION.	Temperature at bottom.		Range.	Average depth in feet and inches.	Mean temperature of the air at station.
	Max.	Min.			
Atlantic City.....	74.5	64.5	9.7	6 9	73.3
Alpena.....	71.8	60.5	11.0	12 0	63.9
Augusta.....	87.5	78.5	9.0	6 0	79.2
Baltimore.....	80.5	75.5	5.0	9 10	76.6
Block Island.....	67.9	67.9	10.0	8 9	69.9
Boston.....	69.	60.5	8.5	25 0	71.7
Buffalo.....	74.7	64.7	10.0	10 0	67.8
Burlington.....	76.	61.3	14.7	19 0	.....
Cedar Keys.....	86.	80.	6.0	10 1	81.5
Charleston.....	84.9	78.7	6.2	40 6	81.3
Chicago.....	69.5	61.4	8.1	7 10	68.6
Chincoteague.....	86.	68.	18.0	6 0	74.2
Cleveland.....	77.	67.5	9.5	14 0	68.7
Detroit.....	73.	66.	7.0	24 0	70.1
Duluth.....	60.	45.	15.0	14 3	61.9
Delaware Breakwater.....	73.3	61.5	11.8	6 6	72.6
Eastport.....	48.2	42.9	5.3	18 2	61.6
Escanaba.....	69.	59.5	9.5	15 0	64.6
Galveston.....	86.	78.	8.0	14 6	82.9
Grand Haven.....	73.5	66.5	7.0	19 0	66.5
Indianola.....	86.8	82.4	4.4	9 3	83.0
Jacksonville.....	88.	82.	6.0	18 0	80.9
Key West.....	90.2	82.8	7.4	15 9	85.0
Marquette.....	57.8	51.9	5.9	10 6	62.9
Milwaukee.....	63.5	49.5	14.0	8 0	66.0
Mobile.....	86.3	79.	7.3	15 9	78.6
New Haven.....	79.8	62.6	17.3	15 2	71.6
New London.....	71.	59.	12.0	12 4	71.2
Newport.....	72.4	56.7	15.7	12 0	70.0
New York.....	76.5	65.	11.5	21 7	73.5
Norfolk.....	84.	75.	9.0	16 11	77.9
Pensacola.....	83.	79.8	3.2	17 9	78.5
Portland, Me.....	61.5	51.	10.5	15 10	71.4
Portland, Oreg.....	71.5	62.2	9.3	74 8	65.3
Port Eads.....	82.	79.	3.0	9 7	80.4
Provincetown.....	90.	83.	7.0	11 10	80.4
Punta Rasa.....	76.8	68.	8.8	10 0	70.2
Sandusky.....	74.3	65.3	9.0	1 7	75.0
Sandy Hook.....	63.5	57.5	6.0	30 7	58.4
San Francisco.....	56.2	51.8	4.4	13 1	81.5
Savannah.....	84.	80.	4.0	10 0	79.3
Smithville.....	68.7	56.	12.7	7 0	68.3
Thatcher's Island.....	78.5	69.5	9.0	11 11	71.8
Toledo.....	86.5	80.5	6.0	13 0	78.0
Wilmington.....	86.5	80.5	6.0	13 0	78.0

\*Observations wanting, from 1st to 20th, inclusive.

#### ATMOSPHERIC ELECTRICITY.

##### AURORAS.

The most important display of the month occurred on the evening of the 16th. It was observed from Eastport Maine,

southward to Delaware Breakwater and westward to stations in Montana. The following reports of this display have been received:

Eastport, Maine: From 8:40 to 11:40 p. m., a brilliant auroral arch was observed, extending from northwest to northeast, with several streamers shooting upward and reaching nearly to the zenith.

Gardiner, Maine: From 9:00 p. m. to midnight, aurora reaching an altitude of  $30^{\circ}$ . Observation interfered with by cloudiness.

Burlington, Vermont: Aurora of pale yellow color, with a few streamers, was observed from 9:00 to 11:40 p. m.

Newport, Vermont: Auroral display during the evening.

Grafton, New Hampshire: Aurora observed at 9:00 p. m.

Springfield, Massachusetts: Aurora visible from 9:00 p. m. to midnight, extending from northeast to northwest and to an altitude of  $25^{\circ}$ . At the beginning of the display bright streamers were observed; later a bright band of light surmounted a dark segment which was irregular in outline and resembled a cloud.

Cambridge, Massachusetts: At 9:45 p. m., a diffused auroral light was observed in the northern sky among and above the clouds. Streamers were suspected at times.

Westborough, Massachusetts: Aurora observed during the evening.

Fall River, Massachusetts: Bright aurora observed from 10:00 p. m. to midnight.

Rowe, Massachusetts: Faint aurora at 9:00 p. m.

Albany, New York: Aurora extending from  $135^{\circ}$  to  $235^{\circ}$  azimuth, of pale yellow color, with well-defined dark segment. The display continued without perceptible change from 11:00 p. m. to daylight of the 17th.

Freehold, New Jersey: Aurora observed in the northern sky, consisting of a white glow with obscure outlines.

Barnegat, New Jersey: Fine auroral display from 8:45 to 11:30 p. m., extending to an altitude of  $32^{\circ}$ .

Atlantic City, New Jersey: At 9:00 p. m. an aurora consisting of an arch of pale yellow color, about  $5^{\circ}$  in width, extending to an altitude of  $15^{\circ}$  and from  $10^{\circ}$  west to  $20^{\circ}$  east of north. At 10:00 p. m. a few faint streamers extended upward to a height of  $30^{\circ}$ , lasting about ten minutes. The display ended at 11:20 p. m.

Delaware Breakwater: Faint aurora observed in the northern sky from 10:00 p. m. to midnight.

Buffalo: Faint aurora consisting of a diffused white light, extending from north-northeast to northwest and to an altitude of  $20^{\circ}$ ; the lower edge rested on a bank of haze about  $8^{\circ}$  above the horizon. The display continued from 10:50 p. m. to 1:35 a. m., of the 17th.

Rochester: Aurora consisting of a few faint slender beams projecting upward to a height of  $20^{\circ}$  from a dark segment. The display was not brilliant. It was first observed at 9:45 p. m. and disappeared before midnight.

Oswego: From 9:00 p. m. to midnight an aurora of varying brilliancy was observed. It extended to an altitude of  $15^{\circ}$  and covered  $70^{\circ}$  of azimuth.

Erie: Auroral display from 9:40 to 11:20 p. m.; beams reaching an altitude of  $60^{\circ}$ , appeared and disappeared at intervals.

Ithaca, New York: Faint aurora, of  $20^{\circ}$  altitude, observed during the evening.

North Volney, New York: Auroral display during the evening.

Meadville, Pennsylvania: Auroral display during the evening.

Cleveland: From 9:30 to 11:00 p. m., faint aurora consisting of a diffuse straw colored light, with a shading of pale green, extending from  $160^{\circ}$  to  $220^{\circ}$  azimuth, and to an altitude of  $25^{\circ}$ .

Grand Haven, Michigan: Faint aurora in northern sky, resembling the morning dawn, extending from  $10^{\circ}$  east to  $10^{\circ}$  west of north and to an altitude of  $5^{\circ}$ ; display began at 9:30 and ended at 11:30 p. m.

Marquette, Michigan: Faint auroral display, from 10:50 to 11:45 p. m.

Franklin, Wisconsin: Aurora, consisting of a white arch, extending from northwest to northeast.

Embarras, Wisconsin: Auroral display observed during the evening.

Dubuque, Iowa: Faint auroral light, from 9:10 to 11:30 p. m. Madison, Wisconsin: A faint, but well-defined auroral arch, visible at 10 p. m.

La Crosse: Faint aurora, of whitish light, visible from 9:00 p. m. to midnight; an arch was formed shortly before its disappearance.

Cresco, Iowa: Faint aurora, consisting of a low arch, with dark cloud beneath, and a few short beams; it extended from north to northeast.

Northfield, Minnesota: Auroral display observed during the evening.

Clear Creek, Nebraska: Faint aurora during the evening.

Alexandria, Dakota: Aurora, with slender luminous beams, increasing in brilliancy as the evening advanced.

Saint Vincent, Minnesota: From 9:20 to 11:30 p. m. aurora, consisting of a well-defined arch, making the dark segment distinctly visible. Brilliant streamers were seen at intervals.

Fort Stevenson, Dakota: Aurora, visible in the northeastern sky, from 9:30 to 11:00 p. m.

Bismarck, Dakota: Aurora visible from 9:00 p. m. to midnight. It appeared as a nebulous light about  $10^{\circ}$  in height.

Fort Keogh, Montana: A few faint auroral beams were observed in the northern sky from 9:45 p. m. until obscured by clouds at 10:30 p. m.

Terry's Landing, Montana: Aurora observed from 10:30 p. m. to 2:00 a. m. of the 17th.

Other auroral displays were less extensively observed on various dates, as follows:

On the 2d, 3d, 4th, 8th, 10th, 13th and 14th, displays, varying in extent and brilliancy, are reported to have been observed at Clear Creek, Nebraska, which were not observed at any other point.

5th: New Athens, Ohio, faint auroral arch observed at 9 p. m.

6th: Huron, Dakota, faint aurora from 9 p. m. until after midnight.

Hatteras, North Carolina: Faint aurora, consisting of a diffuse light of pale straw color, was observed from 10:15 to 11:30 p. m.

7th: Yankton, Dakota, faint auroral arch observed along the northern horizon from 10:10 to 11:25 p. m.

Clear Creek, Nebraska: Faint aurora observed during the evening.

9th: Burlington, Vermont, aurora, of pale yellow color, with a few streamers, observed in the northern sky from 11:00 to 11:45 p. m.

11th: Burlington, Vermont, aurora, consisting of pale yellow light, from 11:00 to 11:45 p. m.

New Corydon, Indiana: Strong auroral light observed from 10:00 p. m. to 2:00 a. m. of the 12th.

Alpena, Michigan: Aurora, consisting of a few small streamers extending to an altitude of  $10^{\circ}$  or  $15^{\circ}$ , with a motion from east to west, was observed from 8:55 p. m. to 1:10 a. m. of the 12th.

12th: Alpena, Michigan, aurora observed at 8:50 p. m., consisting of a diffuse light without streamers.

New Corydon, Indiana: Auroral display at 10:00 p. m.

Clear Creek, Nebraska: Faint aurora during the evening.

Yates Centre, Kansas: Faint auroral display from 9:00 to 10:30 p. m.

15th: Cape May, New Jersey, very faint aurora, extending from north-northwest to northeast, observed from 10:00 to 11:00 p. m.

17th: Alpena, Michigan, from 9:00 to 11:20 p. m., diffuse auroral light, without streamers.

Saint Vincent, Minnesota: Aurora from 9:00 to 11:30 p. m.

18th: Clear Creek, Nebraska, faint aurora during the evening. Yates Centre, Kansas, faint aurora, consisting of parallel arches extending from northwest to east-northeast and to an altitude of about  $30^{\circ}$ .



19th: Burlington, Vermont, aurora of faint green color observed from 10:00 to 11:45 p. m. New Corydon, Indiana, aurora consisting of white segment and small arch, extending to an altitude of 15°, was observed from 9:00 to 11:00 p. m. Alpena, Michigan, diffuse auroral light observed from 9:00 p. m. to 12:35 a. m. of 20th. Saint Vincent, Minnesota, pale yellow auroral light from 9:00 to 11:30 p. m.

20th: Burlington, Vermont, aurora of faint green color from 10:00 to 11:40 p. m. Swanwick, Illinois, aurora consisting of whitish light over a bank of clouds, observed at 9:00 p. m. Saint Vincent, Minnesota, diffuse yellow auroral light observed from 9:30 to 11:30 p. m. Moorhead, Minnesota, faint aurora of diffuse yellow color.

21st: Burlington, Vermont, aurora of faint green and yellow colors.

23d: Fort Madison, Iowa, aurora during the evening.

26th: Tobacco Garden, Dakota, faint aurora observed at 10.20 p. m.

30th: Burlington, Vermont, brilliant auroral display from 10:30 to 11:30 p. m. No arch was visible; bright streamers of pale green were observed.

31st: Burlington, Vermont, from 10:30 to 11:40 p. m., aurora of pale green color. Saint Vincent, Minnesota, auroral arch at 9:00 p. m., of indistinct outlines, reaching an altitude of 30°; beams of pale yellow were observed at intervals. The light of the moon modified the brilliancy of the display.

#### THUNDER-STORMS.

Thunder-storms were reported in the various districts on the following dates:

*New England*: 1st, 3d, 8th, 10th, 13th, 14th, 17th to 22d, 26th to 29th.

*Middle Atlantic states*: 1st, 4th, 6th, 10th to 14th, 18th to 21st, 26th to 31st.

*South Atlantic states*: 1st to 5th, 9th, 11th to 14th, 16th to 23d, 25th, 26th, 28th to 31st.

*Florida peninsula*: 3d to 6th, 8th to 15th, 17th to 21st, 23d to 27th, 29th to 31st.

*East Gulf states*: 1st to 4th, 8th to 23d, 26th to 31st.

*West Gulf states*: 2d, 3d, 4th, 7th, 9th to 31st.

*Rio Grande valley*: 1st, 8th, 9th, 10th, 14th, 17th, 22d, 24th, 30th.

*Ohio valley and Tennessee*: 1st to 5th, 7th, 9th to 14th, 16th to 21st, 26th to 31st.

*Lower lake region*: 1st, 2d, 10th, 12th to 14th, 16th to 19th, 27th, 28th, 31st.

*Upper lake region*: 3d, 9th, 11th, 13th, 16th to 18th, 21st, 24th to 27th.

*Extreme northwest*: 5th to 8th, 12th, 15th, 17th, 22d to 26th, 28th, 29th, 31st.

*Upper Mississippi valley*: 1st to 4th, 6th, 7th, 9th to 23d, 25th to 31st.

*Missouri valley*: 1st to 3d, 5th to 9th, 11th, 12th, 14th to 18th, 20th, 22d to 30th.

*Northern slope*: 1st to 8th, 13th, 14th, 16th to 21st, 23d to 28th, 30th, 31st.

*Middle slope*: 1st to 8th, 11th, 12th, 14th to 23d, 25th to 29th.

*Southern slope*: 3d, 4th, 6th to 9th, 11th to 13th, 15th to 21st, 26th, 28th to 30th.

*Southern plateau*: 1st to 9th, 12th to 29th, 31st.

*Middle plateau*: 1st to 5th, 7th, 17th to 21st, 23d, 24th, 27th, 30th.

*Northern plateau*: 3d, 4th, 20th, 22d, 23d, 31st.

*North Pacific coast region*: 4th, 28th, 31st.

*Middle Pacific coast region*: 3d, 4th, 18th, 19th, 20th.

*South Pacific coast region*: 4th, 5th.

During thunder-storms the following instances of damage by lightning have been reported:

Clay Centre, Kansas, 15th: Two men were killed by lightning at 6.00 p. m., about eight miles from station. 28th, house struck by lightning, and one person killed.

Boston, 28th: Two men killed by lightning.

Dodge City, Kansas, 4th: During thunder, a man was killed by lightning in this city.

Roseburg, Oregon, 4th: About twelve miles north of this place, a barn was struck and burned by lightning, together with six horses, farming implements, hay, etc., entailing a loss of \$5,000.

Cincinnati, 10th: Two men killed by lightning.

Omaha, 29th: During a heavy thunder-storm, a dwelling in Platte county was struck by lightning; one person was killed, and another severely injured.

Texarkana, Arkansas, 12th: During a severe storm, (see LOCAL STORMS,) much damage was done at this place by lightning.

Pike's Peak, Colorado, 1st: At 4.31 p. m., during a heavy fall of hail, lightning struck the station building near the southeast corner, having following the course of the telegraph wire a distance of several rods. The fluid passed through the outer and petition walls and entered the office near the stove, tearing up the floor, melting and tearing off the zinc-sheathing around the stove. The self-registering attachment of the anemometer was demolished, and also the clock which hung upon the office wall. The office wires and anemometer dial were completely burned up. The explosion was terrific. All the window-glass in the office was broken. The observer and assistant were severely stunned and bruised.

Creswell, Kansas, 17th: Dwelling struck and burned by lightning, four miles northwest of this place.

Umatilla, Oregon, 23d: During a severe sand storm, the air was so charged with electricity that office wires and stove-pipe emitted sparks, and when touched produced a shock.

#### OPTICAL PHENOMENA.

##### SOLAR HALOS.

Solar halos have been observed in the various districts on the following dates:

*New England*: 3d, 16th, 22d, 29th.

*Middle Atlantic states*: 18th, 22d, 24th, 25th, 26th, 27th, 29th, 31st.

*East Gulf states*: 7th, 24th, 29th, 30th.

*Ohio valley and Tennessee*: 6th, 11th, 13th, 16th, 20th, 21st, 25th, 30th.

*Lower lake region*: 12th, 16th, 31st.

*Upper Mississippi valley*: 6th, 11th, 19th, 29th.

*Missouri valley*: 6th, 8th, 9th, 16th, 18th.

Solar halos were also reported from the following stations not included in the districts named above:

Saint Vincent, Minnesota, 16th.

Yates Center, Kansas, 9th.

Hatteras, North Carolina, 16th.

Palestine, Texas, 21st, 29th.

Fort Keogh, Montana, 19th.

Tobacco Garden, Dakota, 5th, 18th, 20th.

Salt Lake City, Utah, 16th.

San Francisco, California, 31st.

Grand Haven, Michigan, 30th.

Riley, Illinois, 6th.

##### LUNAR HALOS.

Lunar halos have been observed in the various districts on the following dates:

*New England*: 3d, 17th, 31st.

*Middle Atlantic States*: 21st, 23d, to 28th, 31st.

*South Atlantic states*: 24th, to 29th.

*East Gulf States*: 22d, 23d, 24th, 26th, 28th, 29th.

*West Gulf states*: 20th, 23d, 26th, to 30th.

*Ohio valley and Tennessee*: 2d, 3d, 4th, 7th, 21st, 24th, to 31st.

*Lower lake region*: 29th, 30th.

*Upper lake region*: 2d, 24th, 25th, 26th, 28th.

*Upper Mississippi valley*: 1st, 26th, to 31st.

*Missouri valley*: 1st, 19th, 24th, 26th, 27th.

*Extreme northwest*: 8th, 11th, 23d, 24th.

Lunar halos were also reported from the following stations not included in the districts named above:

Key West, Florida, 29th.  
Terry's Landing, Montana, 26th.  
Helena, Montana, 25th.  
Stockton, Texas, 29th.  
Yuma, Arizona, 7th, 8th, 19th, 20th.  
La Mesilla, New Mexico, 22d.  
El Paso, Texas, 22d, 28th.  
Umatilla, Oregon, 1st, 25th, 27th, 28th, 29th.

#### MISCELLANEOUS PHENOMENA.

##### SUNSETS.

The characteristics of the sky as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from 187 stations show 5,709 observations to have been made, of which 33 were reported doubtful; of the remainder, 5,676, there were 4,646, or 81.8 per cent., followed by the expected weather.

##### SUN SPOTS.

The following record of observations has been forwarded by Mr. D. P. Todd, Director of the Lawrence Observatory, Amherst, Mass.:

DATE— July, 1882.	No. of new		Disappeared by solar rotation.		Reappeared by solar rotation.		Total No. visible.		REMARKS.
	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	
2, 6 p. m.	0	0	2	10	0	0	5	35†	
3, 2 p. m.	0	5	0	0	0	0	5	40†	
5, 4 p. m.	0	0	0	0	0	0	3	25†	
6, 3 p. m.	0	0	0	10†	0	0	2	12	
7, 3 p. m.	0	0	1	5	0	0	1	5	
9, 6 p. m.	0	0	1	5	0	0	0	0	
10, 3 p. m.	2	15†	0	0	0	0	2	15†	
11, 4 p. m.	0	15†	1	1	0	0	1	30†	
12, 3 p. m.	0	0	0	0	0	0	1	25†	Many of the spots small.
13, 3 p. m.	1	5	0	0	1	5	2	30†	Many of the spots small.
14, 3 p. m.	1	15	0	5	0	5	3	40†	Many of the spots small.
15, 3 p. m.	1	10	0	5	0	5	4	45†	Many of the spots small.
17, 3 p. m.	1	15	1	15	1	10	4	35†	Many of the spots small.
19, 3 p. m.	0	0	0	0	0	0	4	35†	
20, 3 p. m.	0	0	0	0	0	0	4	35†	One of spots very large.
22, 3 p. m.	3	10	0	5	2	10	6	40†	
24, 3 p. m.	0	0	0	5	0	0	4	25†	
25, 4 p. m.	0	0	0	0	0	0	3	25†	
26, 2 p. m.	0	0	1	5	0	0	2	30†	
27, 8 a. m.	1	5	0	0	1	5	3	25†	
28, 7 a. m.	0	10	0	5	0	5	3	30†	
29, 11 a. m.	0	0	1	5	0	0	1	15†	
31, 8 p. m.	1	10	0	0	0	0	2	25†	

†Approximated. Faculae were seen at the time of every observation.

Mr. H. D. Govey, at North Lewisburg, Ohio, reports: Sun-spots were observed on all clear days during the month. They were most numerous on the 1st; largest and most active from the 15th to 18th; and smallest at the close of the month.

Mr. David Trowbridge, at Waterburg, New York, reports: 1st, five groups, eight spots; one new group has appeared by rotation. 2d, two groups, four spots. 3d, four groups, twelve spots; one group has disappeared by rotation. 7th, one group, two spots; faculae in the east. 8th, one group, two spots; faculae in the west. 11th, one group, seven spots. 12th, one group, nine spots, (the same group as the 11th.) 13th, one group, two spots; somewhat cloudy. 14th, three groups, ten spots; one large new group just appeared by rotation. 15th, four groups, thirteen spots; one group has arisen since the morning of the 14th. 16th, four groups, (same as 15th,) eleven spots. 17th, two groups, six spots; a large new group, having five spots and a faint spot in the midst of faculae, is situated near the east margin. Two of the faint groups of the 16th have disappeared. 20th, three groups, eight spots; faculae. 21st, four groups, nine spots; faculae. 22d, four groups, nine spots, (same group as 21st;) faculae. 25th, two groups, six spots; faculae. 26th, two groups, seven spots; all faint; faculae numerous. 27th, three groups, seven spots; one new group appeared by rotation; faculae. 29th, one group, six spots. 30th, one group, five spots, (same as 29th).

The following record of observations has been forwarded by Mr. A. S. Bender, of Sacramento, California:

DATE— July, 1882.	No. of new		Disappeared by rotation		Disappeared by rotation.		Total No. of		REMARKS.
	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	
1, 4 p. m.							5	25*	
2, 4 p. m.			1	5*			4	25*	No. of spots increased.
3, 4 p. m.							3	35*	" " "
5, 4 p. m.			1	5*			2	36*	Much change in appearance of spots.
7, 4 p. m.			1	10			1	15*	
8, 4 p. m.			1						
10, 4 p. m.	1	20*					1	20*	Many spots very dim.
13, 4 p. m.	1	5*					2	25*	
14, 4 p. m.	1	10*					3	35*	
17, 4 p. m.			1	10*			1	20*	
20, 4 p. m.	2	20*					3	25*	
25, 4 p. m.			1	5			2	20*	
30, 4 p. m.							1	45*	
31, 4 p. m.							1	45*	

\* Estimated.

##### METEORS.

New York, 15th: A brilliant meteor was observed at 11:15 p. m., moving horizontally from south to north. It was of a bright bluish color, and left behind it a bright track. The duration of its passage was about twenty seconds.

Goldsboro, North Carolina, 1st: A remarkable meteor was observed in the southern heavens about 10:00 p. m. Its disappearance was succeeded by a noise resembling that of a train in motion, as faintly heard in the distance. The following reports probably indicate that the same meteor was observed at Kinston and New Berne, towns lying southeast of Goldsboro, in this state, and distant about twenty-five and fifty-five miles, respectively:

Kinston, 1st: A terrific meteoric explosion occurred between 8:00 and 9:00 p. m., jarring the windows of the houses and lighting up the streets of the town; duration about one second.

New Berne, 1st: A bright meteor was seen about 9:30 p. m., producing a light brighter than that of the moon. A few minutes after its disappearance, a loud report was heard, resembling somewhat that of a cannon. The course of the meteor was nearly south.

Sandford, Florida, 17th: During the evening a brilliant meteor shot across the heavens from south to north. It passed slowly in a direct line, apparently parallel with the earth, and finally disappeared beneath the horizon. The meteor resembled a ball of fire, at white heat, apparently about six inches in diameter, with a luminous tail about six feet in length, varying from a white flame to a dark brick-red. The duration of its flight was about twenty seconds.

The following report of a meteor, as seen by Captain A. J. McGonnigle, U. S. Army, at Whipple Barracks, Arizona, on the evening of July 9th, has been received:

"When first observed, (about 7:50 p. m.) the meteor exhibited the appearance of a bright ball of fire, and seemed fully as large as Venus. As it flashed in sight, it fell rapidly, noiselessly and in a perpendicular line, until it reached nearly the verge of the horizon, as bounded by the mountains to the northwest, when it disappeared as suddenly as it appeared, leaving its whole course clearly defined by a straight, bright, glittering line of light. In a few moments, the lower half of this line appeared to drift westward and rapidly assume a serpentine shape, which was plainly discernible for at least ten minutes. Subsequently, and after the serpentine form faded from view, the spot where the meteor was first observed was indicated in the twilight by what appeared to be a small fleecy cloud."

Topeka, Kansas, 5th: At 9:30 p. m., a very brilliant meteor was observed in the western sky. It started from a point near the tail of Leo, and moved toward the horizon. It was apparently about ten times as large as Jupiter, and was of a yellowish green color.

Fall River, Massachusetts, 28th: At 2:30 a. m., a very bright meteor was observed, which left behind it a bright train, and exploded, lighting up the streets.



Archie, Missouri, 25th: At 8:30 p. m., a very brilliant meteor was observed in the northeastern sky, about 50° above the horizon. Before disappearing it exploded, when two distinct reports were heard.

Murfreesboro, Tennessee, 3d: Between 7:00 and 8:00 p. m., a meteor was observed, apparently of the size of the moon. It was first seen near the zenith; it slowly pursued a southerly course, and exploded before reaching the horizon.

Meteors worthy of less note have been reported as follows:

New Haven, 2d.

Springfield, Massachusetts, 28th, 30th.

Washington, District of Columbia, 31st.

Delaware Breakwater, 30th.

Vicksburg, 10th.

Cleveland, Ohio, 5th.

Davenport, Iowa, 19th, 20th, 22d, 29th.

Wicklow, Dakota, 11th.

Helena, Montana, 13th.

Yuma, Arizona, 3d, 5th, 9th, 10th, 11th, 13th, 14th, 15th, 26th.

Prescott, Arizona, 9th.

Monticello, Iowa, 12th, 13th, 22d.

Fort Madison, Iowa, 25th.

Yates Centre, Kansas, 12th.

Russell, Kansas, 24th.

Fall River, Massachusetts, 12th, 23d.

Protem, Missouri, 9th, 12th, 13th, 14th, 17th, 25th, 26th.

Clear Creek, Nebraska, 15th, 16th.

Murfreesboro, Tennessee, 16th.

#### POLAR BANDS.

Washington, District of Columbia, 31st.

Little Rock, Arkansas, 28th.

Nashville, 3d, 6th, 11th.

New Corydon, Ind., 1st, 2d, 6th, 8th, 10th, 11th, 12th, 15th, 19th, 20th, 29th.

Guttenburg, Iowa, 5th.

Yates Centre, Kansas, 16th, 26th.

Freehold, N. J., 26th.

Wytheville, Virginia, 2d, 21st, 22d, 24th.

#### EARTHQUAKES.

San Francisco, 15th: A sharp shock of earthquake was felt in this city at 7:45 p. m., lasting about seven seconds. The vibration appeared to be from east to west. A very light shock was also felt at 11:08 a. m. of 22d.

Point San José, California, 15th: Slight shock of earthquake felt at this place about 8:00 p. m.

Cairo, Illinois, 20th: An earthquake shock of fifteen seconds duration was felt in this city at 4:00 a. m., which produced a quick rocking motion from southwest to northwest. The shock was sufficient to awaken from sleep, many of the inhabitants.

Cape Mendocino, California, 31st: Light shock of earthquake felt about 12 m. of less than one second duration.

Ironton, Missouri, 28th: A single shock of earthquake was felt at this place on this date.

#### ZODIACAL LIGHT.

Nashville: 3d, 4th, 5th, 9th, 13th, 21st, 23d, 24th, 26th, 27th.

Detroit, Michigan, 18th.

Clay Centre, Kansas, 28th.

Cambridge, Massachusetts: Suspected, 6th.

#### FOREST FIRES.

Sandwich, Massachusetts, 28th: In this vicinity about five miles have been burned over, within which was much valuable woodland. The weather being hot and dry, great difficulty was experienced in fighting the flames. The roots of all shrubs have been burned, and the earth is a complete bed of ashes. During the morning of the 27th a large tract of woodland near Attleborough, was burned over.

East Tawas, Michigan, 27th: Forest fires are raging from Glen Dam to within a mile of Tawas City. Farmers are driv-

ing their cattle to the shore and sending their children to places of safety. On the East Tawas road, three dwellings, much grain, hay and fencing have been burned, entailing great loss. Travel is cut off in many directions. 28th: Fires are still burning to the north, west and south of this place. Fields of grain, farm houses, fences and orchards, together with immense tracts of cedar and pine, are burning. The Hemlock and East Tawas roads are impassable. Brown's Camp, on Hope's creek, has been burned, with a lot of sleighs and lumbering equipage. It is reported that horses, cattle and other stock have been burned, and that farmers are deserting their homes. The fires above Oscodar, have threatened that village.

Less extensive forest fires have been reported from Atco, New Jersey, on the 13th; Bordenton, New Jersey, on the 26th, and at Olympia, Washington territory, on the 11th.

#### MIRAGE.

Indianola, Texas, 19th, 24th, 27th; Swanwick, Illinois, 19th.

#### DROUGHT.

Arkansas: Fort Smith, 25th, cotton and corn are suffering for rain.

Connecticut: New Haven, 31st, reports from all parts of the state show that the drought is very severe. Grass is completely dried up; the hay and berry crops have been much injured. New London, 31st, the month has been very dry and crops have suffered greatly. The oat crop proved a total failure, and was mostly cut to be used as hay.

Illinois: Champaign, 25th, very dry and dusty; rain much needed. 31st, copious rain; drought ended. Springfield, 26th, corn suffering for rain. Charleston, 30th, corn suffering from drought.

Maine: Gardiner, at the close of the month, rain is much needed.

Maryland: Fallston, 29th, before the rain of this date, gardens and the corn crop were suffering from drought. The potato crop will probably be materially shortened in this section.

Massachusetts: Westborough, 31st, month very hot and dry. Brooks and springs are drying up; and are lower than they have been known for many years. Somerset, severe drought during the latter part of the month.

Montana: Fort Missoula, 17th, weather excessively hot and dry; the grass on the adjacent hillsides and surrounding prairie is completely burned up. The drought continued until the rain of the 23d.

New Hampshire: New Market, 31st, month very dry; no rain has fallen since the 20th, and only a few light showers fell during the earlier part of the month. Crops are suffering for rain; on highlands grass is burnt to the ground. The drought is the severest that has been experienced in this section for many years. Contoocookville, 31st, month very hot and dry; vegetation in light soil is suffering severely for rain. Grafton, 31st, severe drought, corn, potatoes, wheat etc., suffering for rain.

New Jersey: Cape May, 31st, the crops in this section have been damaged by the continued drought. Vineland, 31st, month has been very hot and dry; the berry crops have suffered from drought; potatoes have been injured to some extent. Freehold, 26th, crops are suffering much from drought.

New York: Ardenia, at the close of the month, the weather is very dry; crops are suffering for rain, and streams are very low. Palermo, 24th, month very dry; vegetation suffering from drought.

Ohio: Westerville, 26th, the ground is becoming very dry; rain is much needed.

Oregon: Portland, 12th, the wheat crop is very poor, being due to drought. Farmers are mowing and stacking it to be used as hay. Portland, 20th, weather very dry, rain is much needed.

Pennsylvania: Fallsington, 31st, corn is suffering for rain; the ground is very dry and hard.

*Vermont:* Woodstock, 31st, during the last half of the month, the weather was very warm and dry; vegetation is suffering much from drought.

## INSECTS.

Point Judith, Rhode Island, 19th: Army worms appearing in small numbers.

Portland, Maine, 26th: Army worms are reported to be injuring crops in the surrounding country.

Bangor, Maine, 24th: The army worm is reported as doing considerable damage to crops.

Newport, Rhode Island, 21st: Army worms are reported to be very numerous, and are doing much damage to crops in neighboring localities.

New London, Connecticut, 31st: The army worm made its appearance about the 10th, and proved very destructive to grass and crops for ten or twelve days; very few were seen after the 29th.

New York, 15th: Army worms are doing great damage to oats, barley, corn and grass in Suffolk county, and along the Connecticut coast.

Fort Missoula, Montana, 17th: Grasshoppers are appearing in great numbers.

Charleston, Illinois, 6th: The army worm has done considerable damage to meadows. 30th: Chinch bug is doing much damage to corn.

Vevay, Indiana, 2d: Insects are proving destructive to vines and flowers.

Creswell, Kansas, 9th: Large numbers of chinch bugs are appearing in this locality.

Fall River, Massachusetts, 16th: Army worms are reported to have appeared in great numbers on farms in this vicinity. They have also made their appearance in this city, on lawns and other grassy places. On the 25th, corn and oats are being destroyed by army worms.

Somerset, Massachusetts, 18th: Army worms have appeared in large numbers, and have destroyed many acres of grain.

## WATER-SPOUTS.

Cleveland, Ohio, 4th: During the afternoon, heavy, sullen clouds were observed on the northeastern horizon. At about 6.00 p. m., they were driven by a northeast wind toward the city. When about one mile distant, over the lake, a revolving motion was noticed near the edge of the cloud, and a cone was gradually formed, which descended to the surface of the lake, forming a perfect water-spout. Two other water-spouts were afterwards observed in the vicinity of Rocky river, five miles west of the city. All disappeared when they approached the shore.

## SAND STORMS.

Coleman City, Texas, 12th.

Fort Cummings, New Mexico, 10th.

Camp Thomas, Arizona, 3d, 6th, 8th, 13th, 15th, 17th, 18th, 30th.

Lewiston, Idaho, 9th, 13th, 24th.

Umatilla, Oregon, 4th, 23d.

Fort Union, New Mexico, 2d, 15th.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR :

W. B. HAZEN,

*Brig. & Bvt. Maj. Gen'l,*

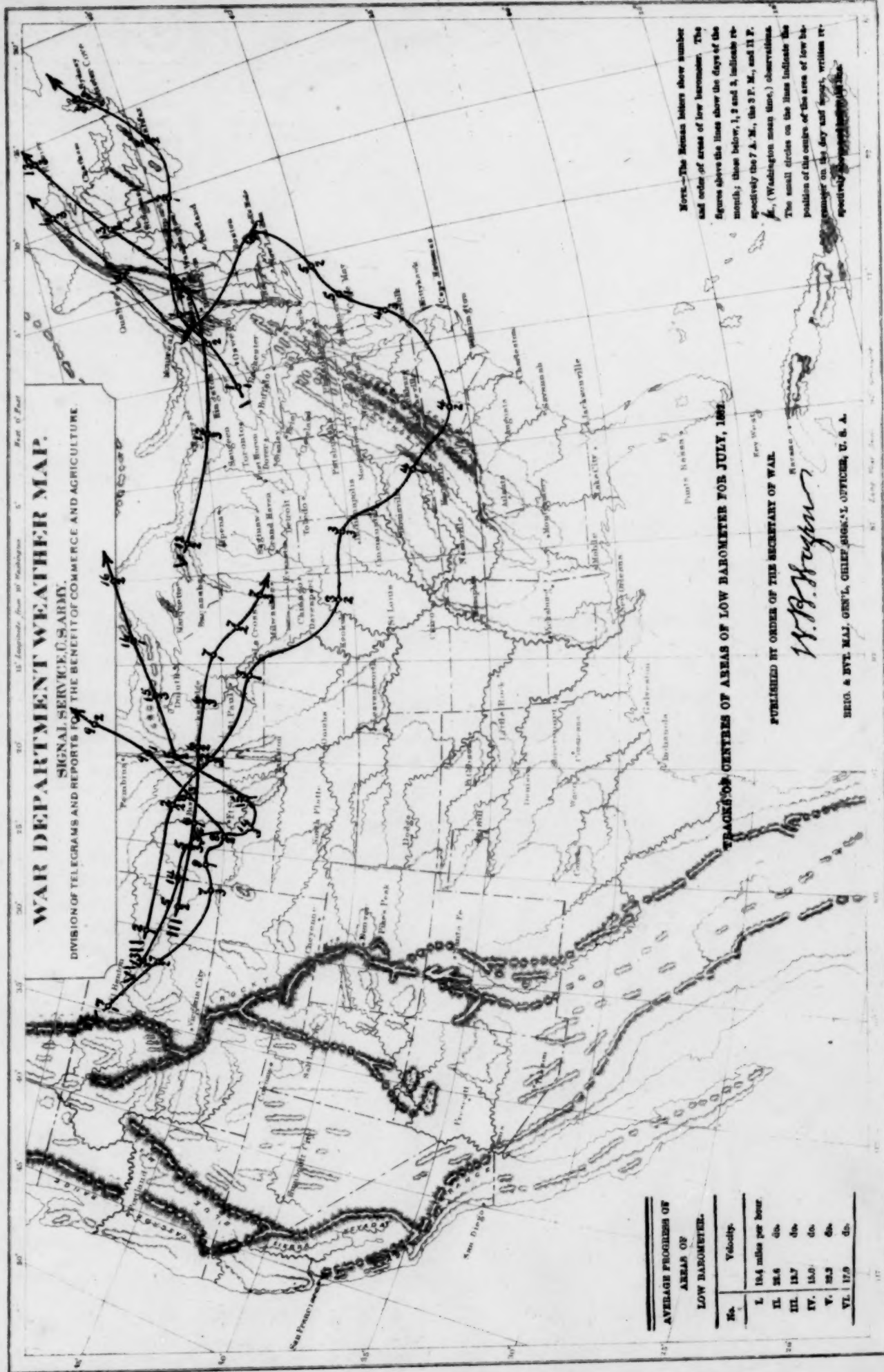
*Chief Signal Officer, U. S. A.*

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**Notes.**—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7 A. M., the 3 P. M., and 11 P. M. (Washington mean time.) observations. The small circles on the lines indicate the position of the center of the area of low barometer on the day and hour, written respectively above and below the line.

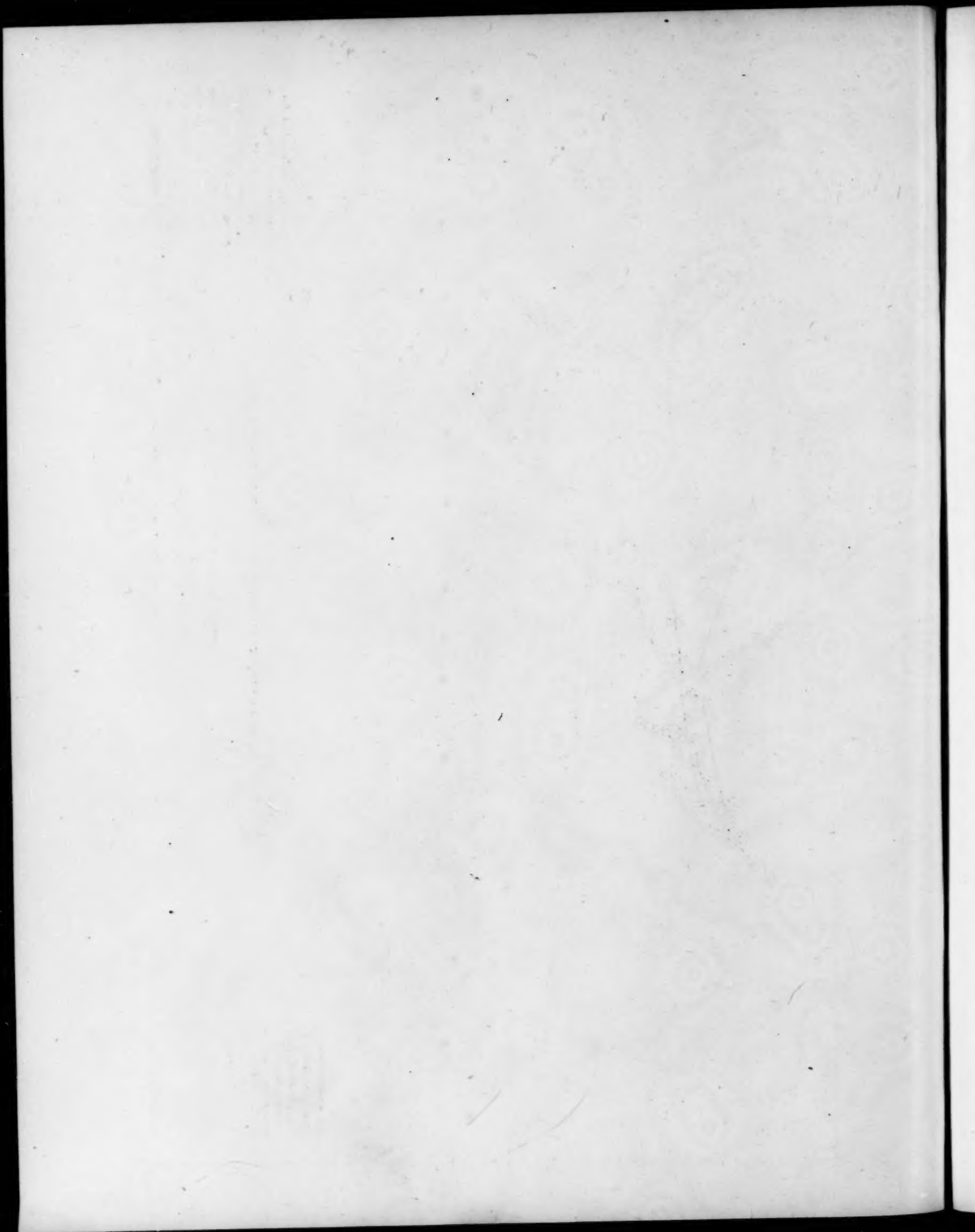
TRACKS OF CENTRES OF AREAS OF LOW BAROMETER FOR JULY, 1918.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

*W. H. Hays*

BRIG. & BYT. MAJ. GEN'L. CHIEF SIGNAL OFFICER, U. S. A.

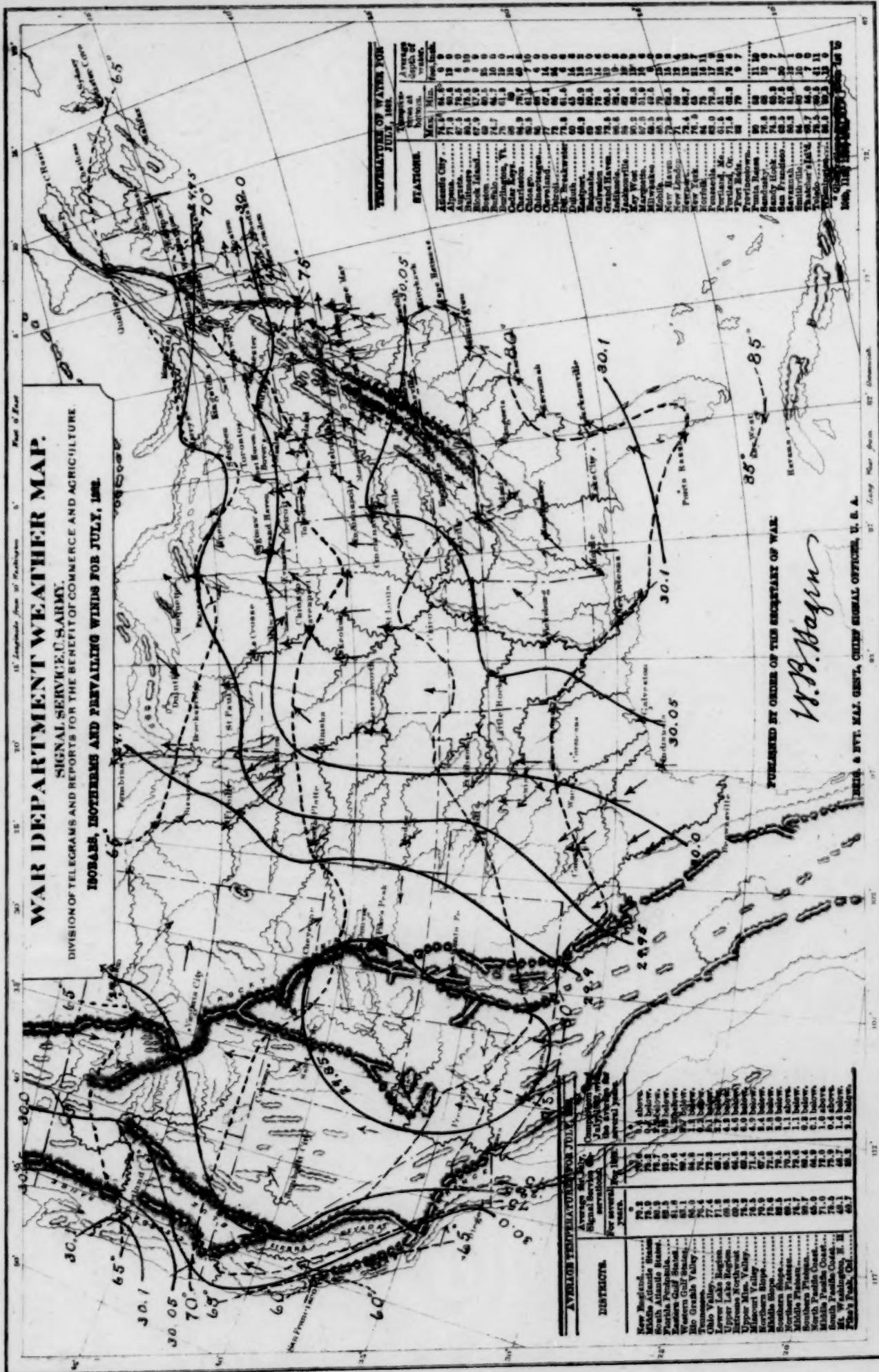
AVERAGE PROGRESS OF AREAS OF LOW BAROMETER.	
No.	Velocity.
I.	18.4 miles per hour.
II.	23.6 do.
III.	13.7 do.
IV.	15.0 do.
V.	22.5 do.
VI.	17.0 do.





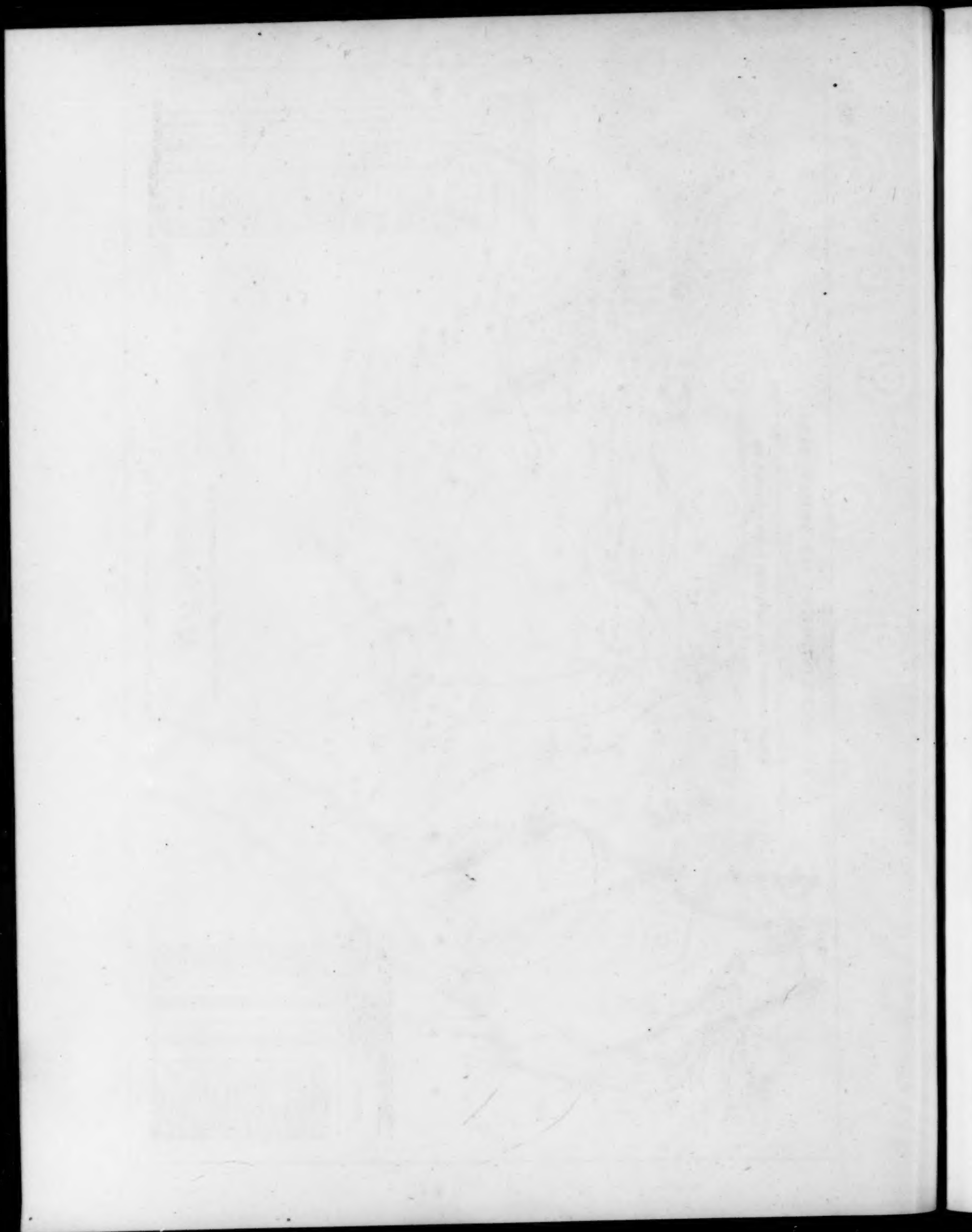
# WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U. S. ARMY.  
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.  
ISOBARS, ISOTHERMS AND PREVAILING WINDS FOR JULY, 1918.



TEMPERATURES OF WATER FOR JULY, 1918.

STATIONS.	Mean at surface.		Mean at 10 fms.		Mean at 20 fms.		Mean at 30 fms.		Mean at 40 fms.		Mean at 50 fms.		Mean at 60 fms.		Mean at 70 fms.		Mean at 80 fms.		Mean at 90 fms.		Mean at 100 fms.		Mean at 110 fms.		Mean at 120 fms.		Mean at 130 fms.		Mean at 140 fms.		Mean at 150 fms.		Mean at 160 fms.		Mean at 170 fms.		Mean at 180 fms.		Mean at 190 fms.		Mean at 200 fms.		Mean at 210 fms.		Mean at 220 fms.		Mean at 230 fms.		Mean at 240 fms.		Mean at 250 fms.		Mean at 260 fms.		Mean at 270 fms.		Mean at 280 fms.		Mean at 290 fms.		Mean at 300 fms.		Mean at 310 fms.		Mean at 320 fms.		Mean at 330 fms.		Mean at 340 fms.		Mean at 350 fms.		Mean at 360 fms.		Mean at 370 fms.		Mean at 380 fms.		Mean at 390 fms.		Mean at 400 fms.		Mean at 410 fms.		Mean at 420 fms.		Mean at 430 fms.		Mean at 440 fms.		Mean at 450 fms.		Mean at 460 fms.		Mean at 470 fms.		Mean at 480 fms.		Mean at 490 fms.		Mean at 500 fms.		Mean at 510 fms.		Mean at 520 fms.		Mean at 530 fms.		Mean at 540 fms.		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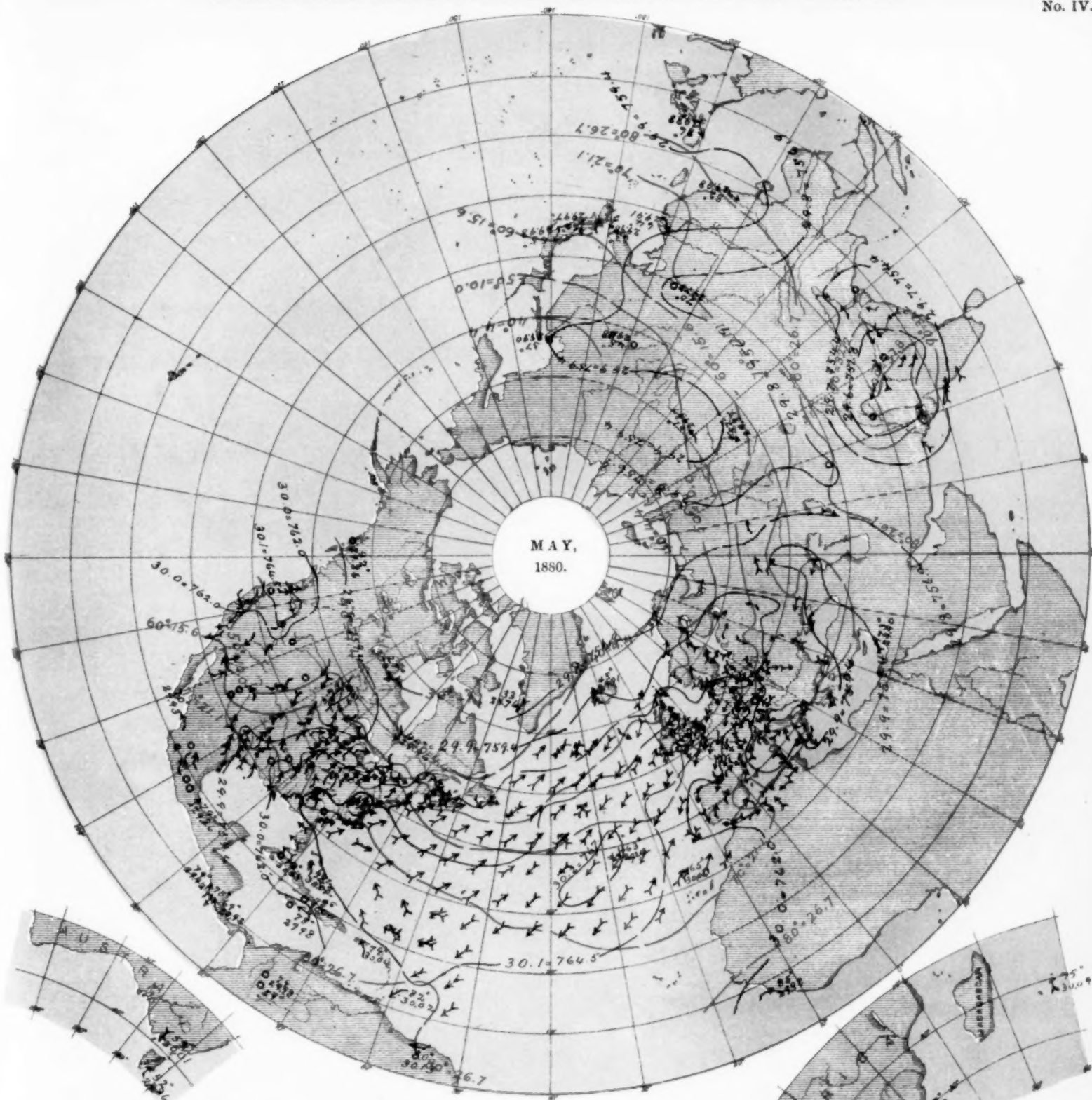


# Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously, Series commencing January, 1877.

No. IV.



## PREVAILING WINDS.

Arrows show the direction of, and fly with, the wind.  
Force is shown as follows:

SYMBOLS.	FORCE.	VELOCITY.	
		Miles per hour.	Metres per second.
	0	0	0
	1, 2	0 to 9	0 to 4.0
	3, 4	9.1 to 22.5	4.1 to 10.1
	5, 6	22.6 to 40.5	10.1 to 18.1
	7, 8	40.6 to 67.5	18.1 to 30.2
	9, 10	67.6 up.	30.2 & over.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

*W.B. Bryan*

BRIG & BVT. MAJ. GEN'L.

CHIEF SIGNAL OFFICER, U. S. A.

## INTERNATIONAL MONTHLY CHART.

Showing mean pressure, mean temperature and prevailing direction of winds at 7.35 A.M., Washington mean time, for the month of May, 1880, based on the daily charts of the International Bulletin.

## ISOBARS AND ISOTHERMS.

Isobars in black; detached barometer means in English inches.

Isotherms in red; detached temperature means in degrees Fahrenheit.

Broken lines, are doubtful.



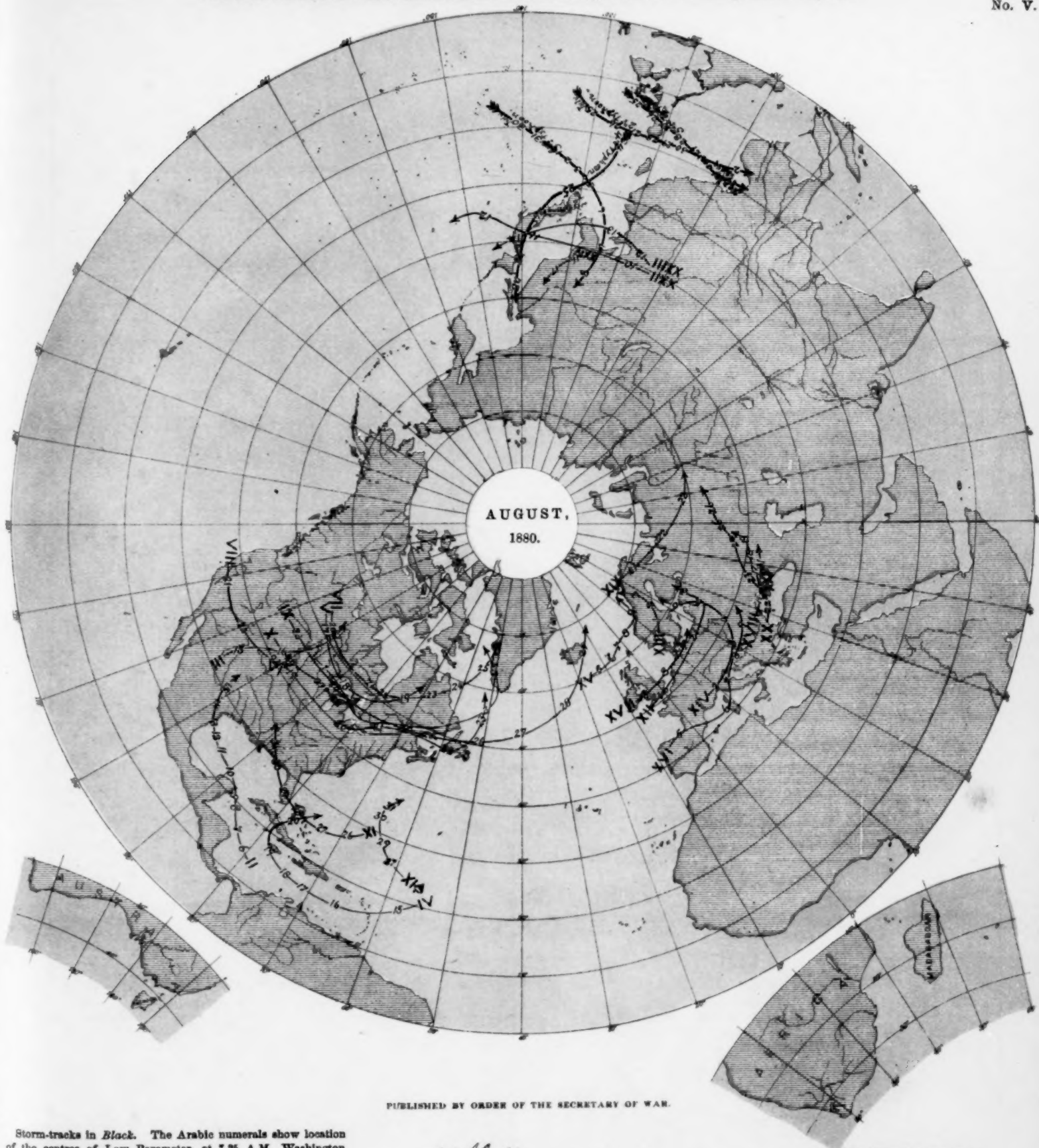


# Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously, Series commencing November, 1877.

No. V.



PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Storm-tracks in Black. The Arabic numerals show location of the centres of Low Barometer, at 7.35 A.M., Washington mean time, of that date.

Broken or dotted lines, are doubtful.

*W.B. Hayes*

BRIG & HVT. MAJ. GEN'L.  
CHIEF SIGNAL OFFICER, U. S. A.

INTERNATIONAL CHART.  
Showing Tracks of Centres of Low Barometer for  
August, 1880.

NO. 1000



No. VI.  
CHART SHOWING THE LIMIT OF ICEBERGS DURING THE MONTH OF JULY 1888 FROM OBSERVATIONS ON THE "ALBATROSS"



No. VI.

CHART SHOWING THE LIMIT OF ICEBERGS DURING THE MONTH OF JULY, 1882, FROM OBSERVATIONS ON FILE IN THE  
OFFICE OF THE CHIEF SIGNAL OFFICER.

